ENGINEERING NEWS-RECORD

A McGRAW-HILL PUBLICATION

DECEMBER 11, 1947

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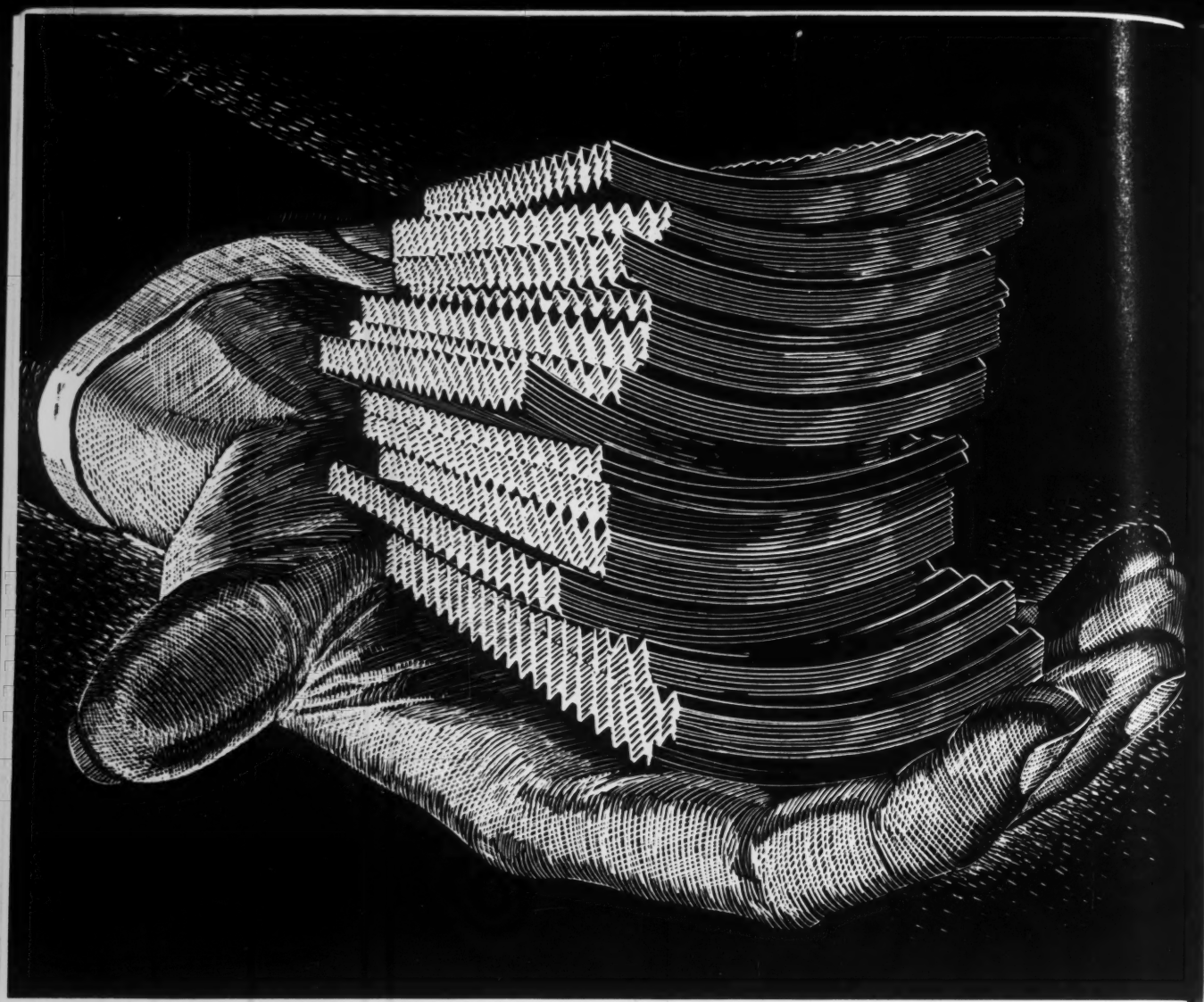

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Volume 139 • Number 24

December 11, 1947

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ENGINEERED DESIGN OF SWIMMING POOLS

Design of swimming pools is a highly specialized function which draws upon the skills of the sanitary, structural, hydraulic and mechanical engineer. When a pool is designed by a qualified consultant, more pleasing appearance, improved sanitation, safety, and economical operation usually result. Some of the pitfalls to be avoided and design requirements for good swimming pools will be discussed in the Dec. 25 issue.

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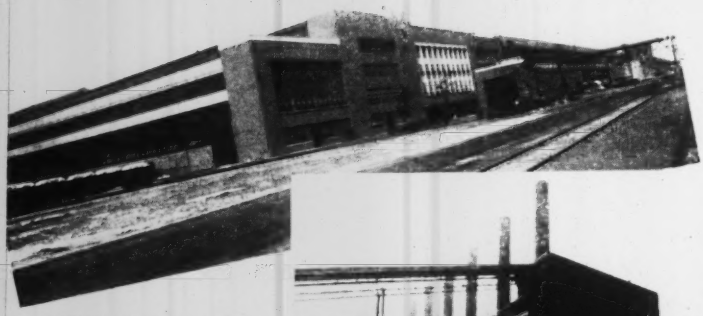
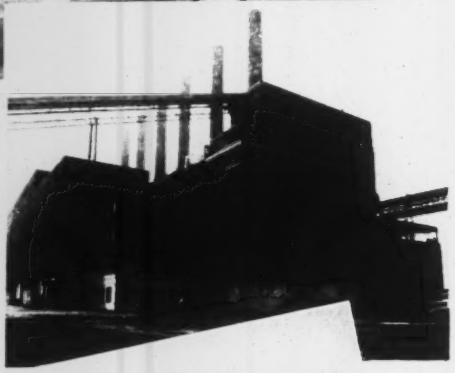
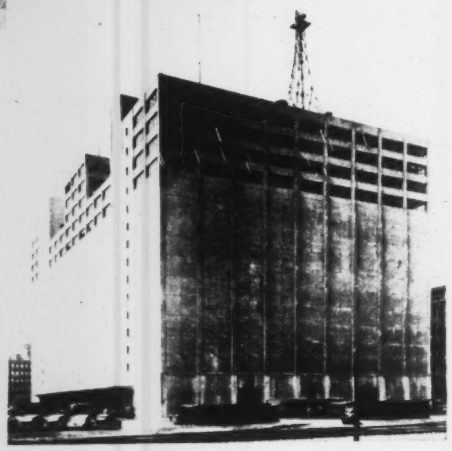
WESTERN FOUNDATION PILES SINCE 1924





ABOVE — Ford Press Shop, Detroit, Mich. America's biggest H-Beam job.

RIGHT — Union Electric Power Co., Venice, Ill. Button Bottom Piles* combined with steel pipe piles.



ABOVE — Extension, Republic Steel Plant, Cleveland, O. One of the biggest pipe pile jobs in the world.

RIGHT — Building No. 77, Brooklyn Navy Yard, N. Y., rests securely on Drilled-In Caissons.*

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Construction Trends

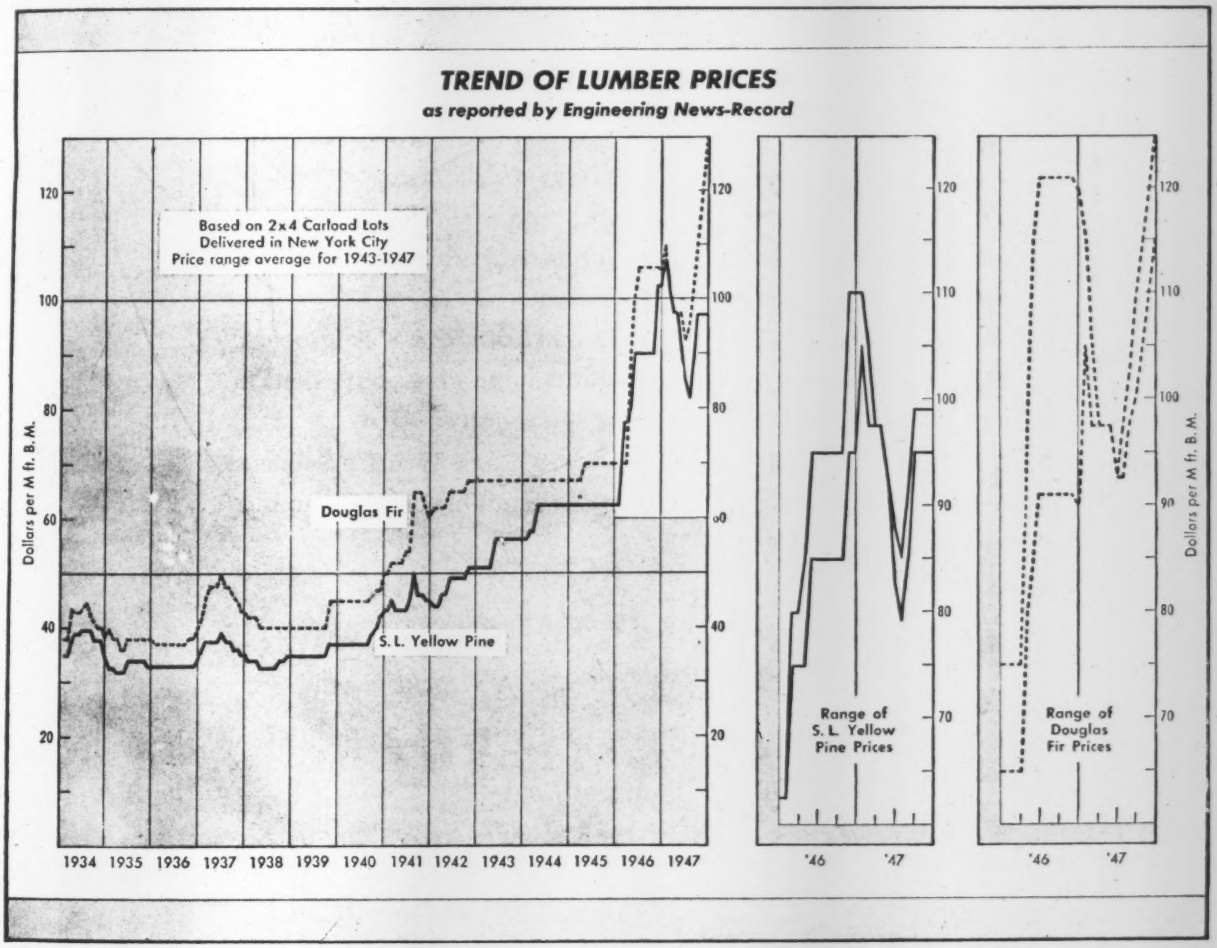
Lumber Prices At New Record Highs

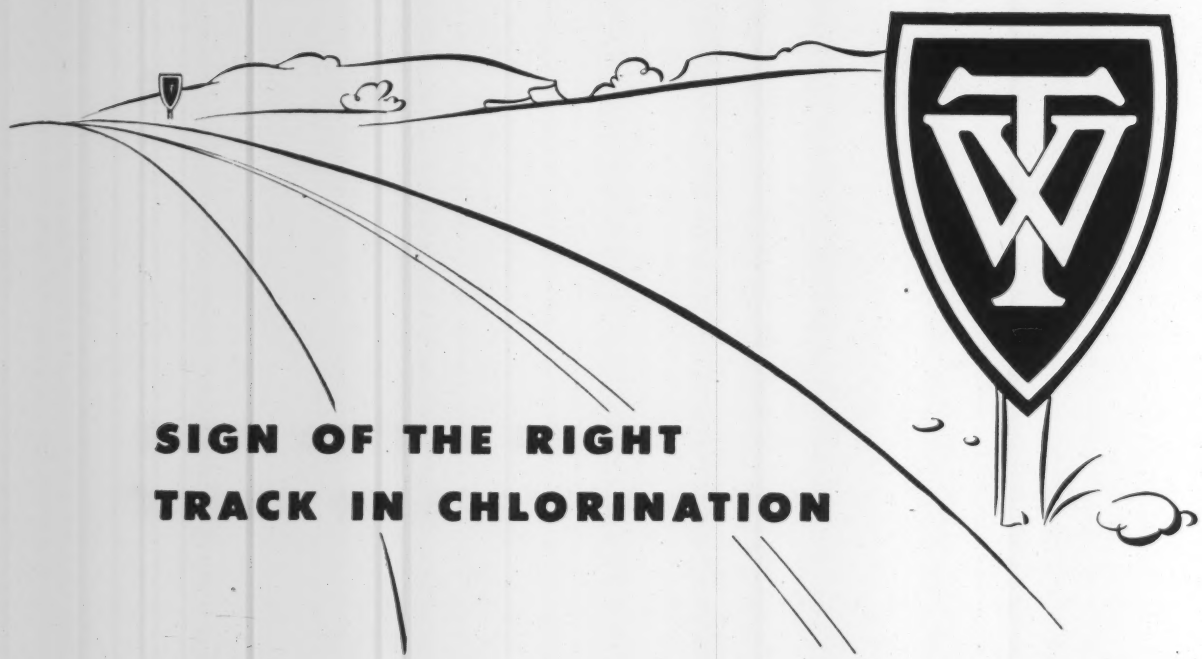
December lumber prices for the United States as a whole, as measured by *Engineering News-Record's* 20-cities average of 2x4 lumber, rose to new high records this month of $96.74 per M ft. bm. for Douglas Fir and $87.09 per M ft. for Yellow Pine. The lows, prior to the present upward movement, of $86.38 per M ft. for Douglas Fir and $77.51 for Yellow Pine were reached in July.

December price of 2x4 Douglas Fir lumber delivered in the New York area rose for the sixth consecutive month to a new high range of $115 to $125 per M ft. bm. from the previous low of $92.50 reached in June. Short leaf Yellow Pine price of $95 to $99 per M ft. in December, however, was still below the record high of $105 to $110 reached at the beginning of this year, after rising from the previous low of $79 to $85 in July. The following chart shows the trend of New York lumber prices from 1934 through 1947.

After rising continuously during the war years, U. S. lumber prices continued to rise in the postwar era through May, 1947. The Douglas Fir price average rose to $83.83 per M ft. in May from the January, 1946 price average of $54.99, an increase of 62 percent. Southern Pine rose to $84.89 from $54.55 during the same period, an increase of 56 percent. A weakening of lumber prices occurred during June and July of this year, but was not sustained in the latter part of 1947. The 20-cities average of Douglas Fir prices for December showed an increase of 76 percent over the January, 1946 average and 9 percent over the May, 1947 average. Short leaf Yellow Pine prices are now 60 percent above January, 1946 and 3 percent above May, 1947.

Recent lumber price rises have accounted for 53 percent of the increase in the material cost component, used in computing *Engineering News-Record's* building and construction cost indexes, from July to December of this year. The material cost component rose 17.18 points during this period, with lumber price rises accounting for 9.03 points of this increase.

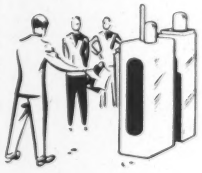




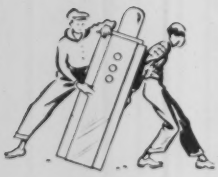
SIGN OF THE RIGHT TRACK IN CHLORINATION

From start to finish in any job involving chlorination — whether it's drinking water sterilization, sewage treatment, swimming pool disinfection or process or cooling water treatment — you'll be on the right track to practical answers to your problems when you rely on the skill behind the W & T shield.

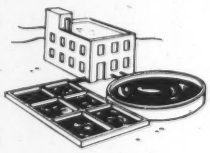
In DESIGN you'll find W & T Engineers willing and helpful. They can draw from more than thirty years' experience in making practical recommendations.



In BUYING you'll find W & T Equipment right for the job — large or small — industrial or municipal.



When it's time to INSTALL you'll find both W & T Engineers and Equipment on the job at the right time to give your client a workable installation fully meeting the requirements.



And, finally, LIVING with the job you'll find W & T's Service Organization always on call to ensure dependable, uninterrupted chlorination.

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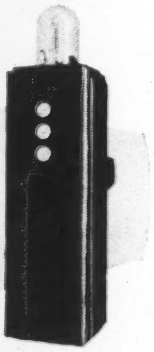

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CHLORINE AND CHEMICAL CONTROL EQUIPMENT

NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

S-15

New Construction Volume in November

Civil engineering construction volume in continental United States totals $474,357,000 for November, an average of $118,589,000 for each of the four weeks of the month. This average is 3 percent above the average for October, and 72 percent above the average for November, 1946, according to *Engineering News-Record*.

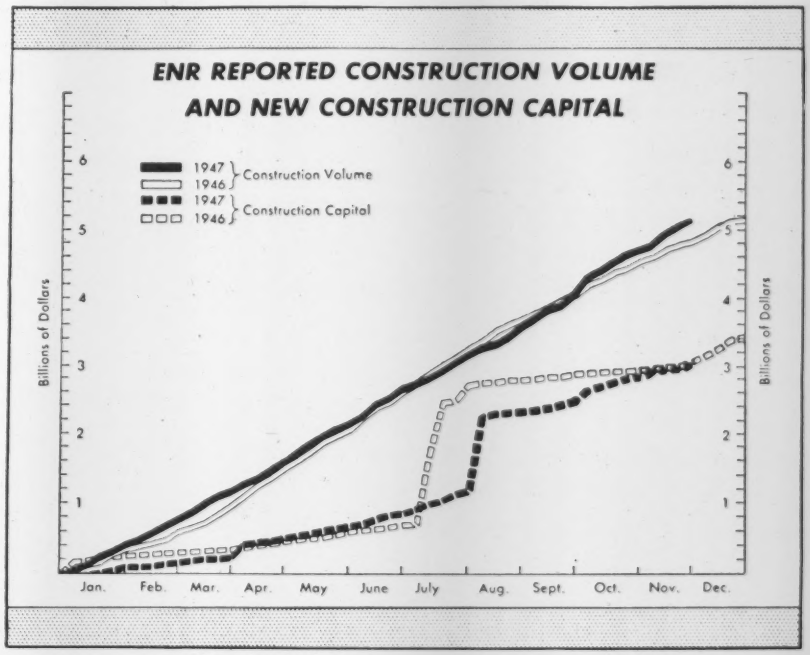
Private construction for November on a weekly average basis is 20 percent below last month, but 67 percent above November, 1946. Public construction is 39 percent above last month, and 77 percent above last November. State and municipal construction is 32 percent above last month, and 137 percent above the average for November, 1946. Federal construction, up 86 percent from last month, is 17 percent below November, 1946.

Weekly averages in the various classes of construction for November, 1947 compared with October, 1947 show gains in sewerage, of 391 percent; waterworks, 262 percent; earthwork and drainage, 92 percent; public unclassified, 79 percent; public buildings, 9 percent; and private unclassified, 3 percent. Losses are recorded for highways, 11 percent; industrial buildings, 19 percent; commercial buildings, 24 percent; and public bridges, 45 percent.

Geographically, three sections showed gains in November, 1947 over October—Far West, 44 percent; Middle West, 31 percent; and South, 10 percent. Middle Atlantic dropped 10 percent; West of the Mississippi, 13 percent; and New England, 26 percent.

All six sections made gains in November over November, 1946—South, 141 percent; Middle West, 120 percent; Middle Atlantic, 88 percent; West of the Mississippi, 69 percent; New England, 17 percent; and Far West, 9 percent.

New capital for construction for the four weeks of November, 1947 totals $259,694,000, or a weekly average of $64,924,000 for the month. The weekly average is thus 0.3 percent below the weekly average of $65,126,000 for October, 1947 and 87 percent above the weekly average of $34,754,000 for November, 1946.



ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—NOVEMBER, 1947

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—Waterworks, excavation, drainage and irrigation, $22,500 other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000*

Four Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississiopi	Far West	United States November 1947	United States Eleven Months 1947	United States Eleven Months 1946	Canada
Public Works										
Waterworks	66	14,572	2,364	1,794	3,213	10,572	32,581	125,993	101,414	495
Sewerage	1,151	8,110	6,288	24,860	4,082	1,747	46,238	161,962	105,836	45
Bridges, public	1,151	2,165	3,165	2,402	3,007	1,006	12,896	173,759	120,497	566
Earthwork and waterways	22	445	2,866	2,035	20,809	2,209	28,386	278,028	343,492	1,460
Streets and roads	3,429	7,402	10,225	9,645	18,130	5,010	53,841	738,880	725,581	105
Buildings, public	592	12,504	12,245	13,673	11,921	5,803	56,738	551,650	388,134	4,402
Unclassified, public	279	3,313	3,801	1,676	3,355	6,868	19,292	230,142	151,125	96
Total public	**6,690**	**48,511**	**40,954**	**56,085**	**64,517**	**33,215**	**249,972**	**2,260,414**	**1,936,079**	**7,229**
Federal government (included in above classifications)	317	1,016	11,671	2,505	23,590	6,773	45,872	569,749	613,319	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	824	2,092	.....
Industrial buildings	2,032	10,379	3,768	9,166	10,708	29,013	65,066	817,527	969,754	6,841
Commercial buildings	2,395	63,965	23,400	9,002	19,256	13,208	131,226	1,690,623	1,758,174	4,020
Unclassified, private	55	3,207	13,425	2,203	8,822	381	28,093	386,460	181,344	30,060
Total private	**4,482**	**77,551**	**40,593**	**20,371**	**38,786**	**42,602**	**224,385**	**2,895,434**	**2,911,364**	**40,861**
Total Engineering Construction;										
November, 1947 — 4 weeks	**11,172**	**126,062**	**81,547**	**76,456**	**103,303**	**75,817**	**474,357**	.....	.....	**48,090**
October, 1947 — 5 weeks	18,983	175,960	92,755	72,746	148,720	65,925	575,089	.....	.....	44,374
November, 1946 — 4 weeks	9,519	66,995	33,865	34,756	60,976	69,714	275,825	.....	.....	15,887
Eleven Months — 1947	**190,168**	**1,355,017**	**879,122**	**709,178**	**1,222,951**	**799,412**	.....	**5,155,848**	.....	**382,222**
Eleven Months — 1946	279,811	1,146,502	752,781	587,545	993,937	1,086,867	.....	.....	4,847,443	288,310

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Inland 4-Way Floor Plate	Sheets and Strip Steel	& Machinery, etc.

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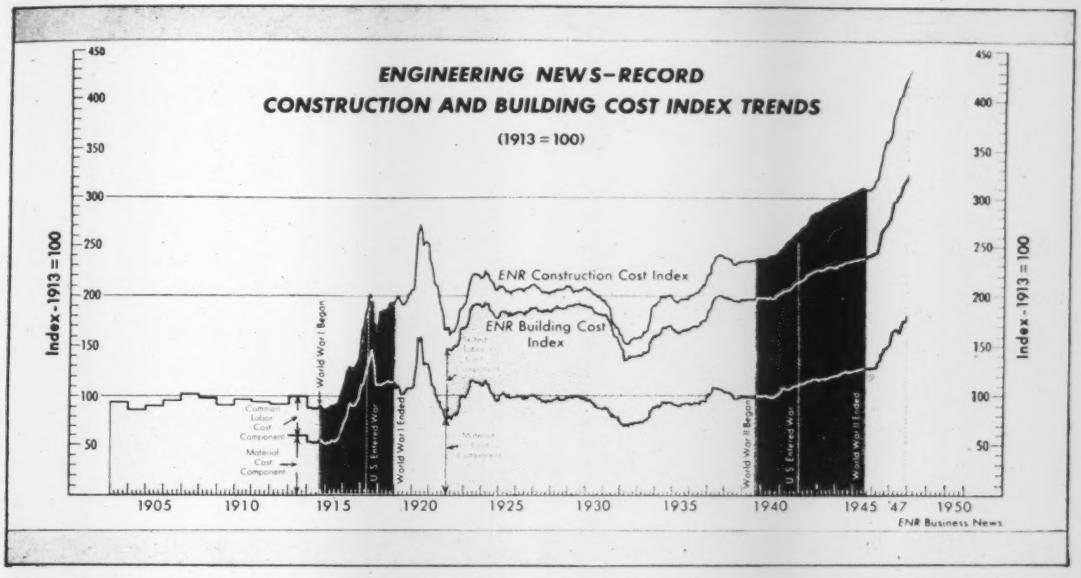
RYERSON STEEL

DECEMBER CONSTRUCTION BUSINESS REPORT



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (, 000 omitted)	November 1946 (4 wk.)	November 1947 (4 wk.)	% Change	Eleven Months 1946 (48 wk.)	Eleven Months 1947 (48 wk.)	% Change
Total U. S. Construction	$275,825	$474,357	+72	$4,823,179	$5,155,848	+7
Private Construction	134,728	224,385	+67	2,911,364	2,895,434	−1
Public Construction	141,097	249,972	+77	1,911,815	2,260,414	+18
Federal	54,991	45,872	−17	589,055	569,749	−3
E N R Construction Volume Index, 1913 = 100	164	238	+45	252	229	−9
Total New Productive Capital	$139,015	$259,694	+87	$3,134,836	$3,104,293	−1
Private Investment	139,015	259,694	+87	1,195,141	2,037,853	+71
Federal (non-federal work)	.....	.....	.....	225,000	247,711	+10
Federal (federal work)	.....	.....	.....	1,714,695	818,729	−52

CONSTRUCTION COST . . . . WAGE RATES . . . . MATERIAL PRICES

1913 = 100	December 1946	December 1947	% Change	Change Nov. to Dec. 1946 Nov.	1946 Dec.	1946 %	1947 Nov.	1947 Dec.	1947 %
E N R Constr. Cost Index†	368.10	432.30	+17.44	362.47	368.10	+1.55	429.30	432.30	+0.70
E N R Building Cost Index†	278.77	325.27	+16.68	273.99	278.77	+1.74	322.27	325.27	+0.93

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

	December 1946	December 1947	% Change	Nov. 1946	Dec. 1946	%	Nov. 1947	Dec. 1947	%
Common Labor	$1.084	$1.264	+16.61	$1.077	$1.084	+0.65	$1.264	$1.264	0.0
Skilled Labor (Av. 3 Trades)	1.869	2.120	+13.43	1.861	1.869	+0.43	2.120	2.120	0.0
Bricklayers	1.988	2.259	+13.63	1.981	1.988	+0.35	2.259	2.259	0.0
Structural Ironworkers	1.876	2.139	+14.02	1.865	1.876	+0.59	2.139	2.139	0.0
Carpenters	1.744	1.963	+12.56	1.738	1.744	+0.35	1.963	1.963	0.0
Structural Steel, base	2.35	2.80	+19.15	2.35	2.35	0.0	2.80	2.80	0.0
Sand, per ton	1.529	1.843	+20.54	1.517	1.529	+0.79	1.824	1.843	+1.04
Lumber, 2x4 Fir, per M ft.	72.172	96.74	+34.04	69.780	72.172	+3.43	92.931	96.74	+4.10
Lumber, 2x4 Pine, per M ft.	67.739	87.09	+28.57	64.311	67.739	+5.33	85.54	87.09	+1.81
Common brick, per M	22.325	24.213	+8.46	22.225	22.325	+0.45	23.813	24.213	+1.68
Ready-mixed concrete, c.y.	8.438	9.389	+11.27	8.323	8.438	+1.38	9.261	9.389	+1.38
Struct. clay tile, 3x12x12	98.673	118.76	+20.36	98.379	98.673	+0.30	117.96	118.76	+0.68

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	November 1946	November 1947	% Change	Oct. 1947	% Change Oct. to Nov.
Steel (% Operating Capacity) A.I.S.I., weekly average	86.1	96.6	+12.2	96.3	+0.3

	September 1946	September 1947	% Change	Nine Months 1946	Nine Months 1947	% Change
Cement, thous. bbl. U.S.B. of Mines	17,153	19,840	+15.7	125,318	138,184	+10.3

	October 1946	October 1947	% Change	Ten Months 1946	Ten Months 1947	% Change
Fabricated Structural Steel, tons, A.I.S.C.	164,730	173,580	+5.4	1,252,262	1,544,617	+23.3
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$171,213	$325,882	+90.3	$2,250,269	$2,488,294	+10.6

COST OF LIVING INDEX . . . . EMPLOYMENT

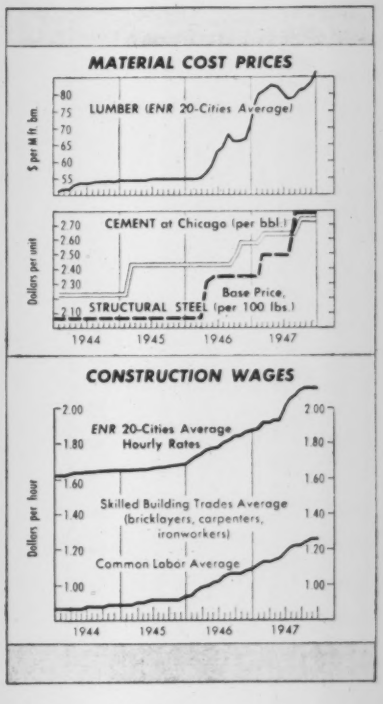
Base 1935–39 = 100	1941	September 1946	September 1947	% Change 1946 to 1947	August 1947	% Change Aug. to Sept.
Consumers' Price Index, B L S	105.2	145.9	163.8	+12.3	160.3	+2.2
Rent (Housing) Index, B L S	106.2	108.8	113.6	+4.4	111.2	+2.2

	September 1946	September 1947	% Change	August 1947	% Change Aug. to Sept.
Contract Constr. Employ. (est.), thous., B L S*	1,747	1,883	+7.8	1,900	−0.9

**Component of B L S Total Non-Agricultural Employment Series. Comparable monthly figures available back to January, 1939.*

ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume c'26
Dec., 1947	432.30	207.81	325.27	175.83		
Nov., 1947	429.30	206.36	322.27	174.21	238	104
Oct., 1947	424.41	204.01	320.58	173.30	234	103
Sept., 1947	417.81	200.84	317.08	171.40	255	112
Aug., 1947	415.00	199.49	313.03	169.21	215	94
July, 1947	406.52	195.41	304.87	164.80	222	97
June, 1947	403.29	193.86	303.54	163.87	276	121
May, 1947	396.49	190.59	299.61	161.96	224	98
Apr., 1947	396.09	190.40	300.81	162.61	247	108
Mar., 1947	391.95	188.41	298.84	161.54	220	96
Feb., 1947	390.76	187.84	297.65	160.90	197	86
Jan., 1947	381.68	183.47	289.05	156.25	195	86
Dec., 1946	368.10	176.95	278.77	150.69	207	91
Nov., 1946	362.47	174.24	273.99	148.11	164	72
1946 (Av.)	345.94	166.29	262.25	141.76	248	109
1945 (Av.)	307.75	147.93	239.14	129.27	123	54
1944 (Av.)	298.72	143.59	234.73	126.89	96	42
1943 (Av.)	289.95	139.38	228.25	123.66	176	77



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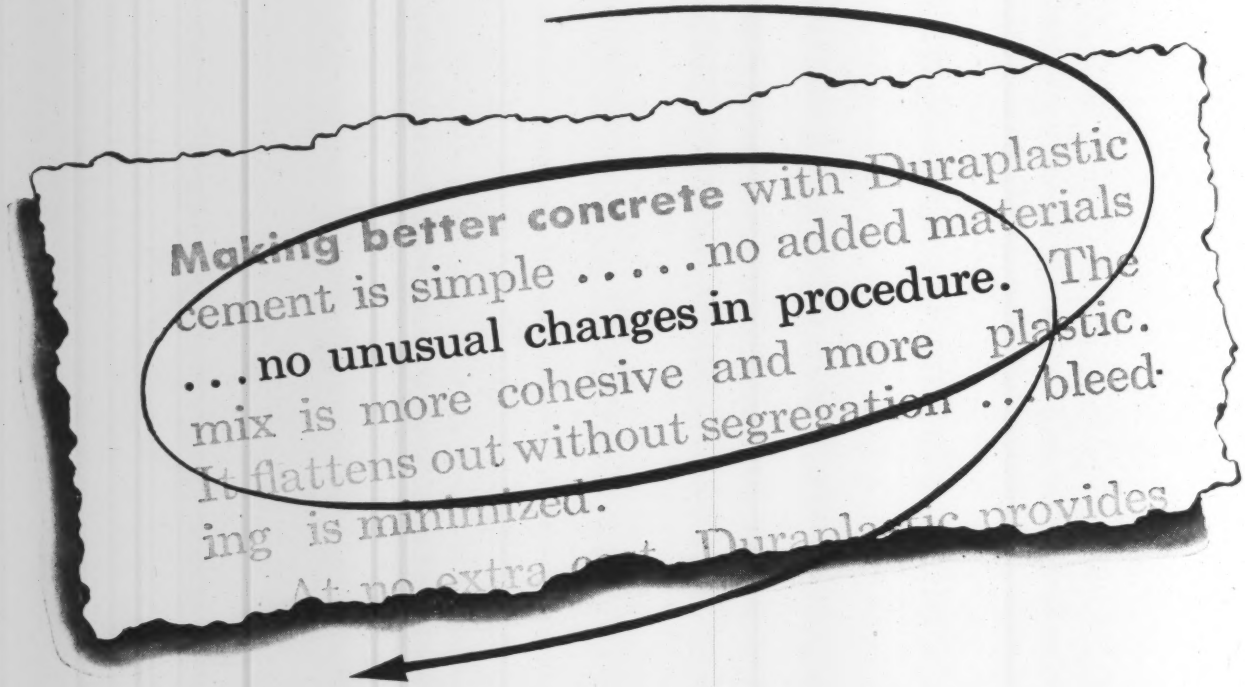
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ENR-D-57

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News of the Week

ENGINEERING NEWS-RECORD • DECEMBER 11, 1947 • VOLUME 139 • NUMBER 24

Score construction industry in NAM report on housing

National Association of Manufacturers finds industry, laws, labor at fault in survey of nation's efforts to provide more housing at lower costs

In a voluminous report that spared neither the construction industry, labor nor the law for delaying construction and increasing the cost of housing, a special committee of the National Association of Manufacturers last week made public its findings on the housing industry.

Earl Bunting, president of the NAM, told members attending the annual convention in New York City that he had presented the committee's report to a joint Congressional committee investigating the housing situation.

Briefly, the report charged the construction industry with being made up of units too small, lacking in responsibility and backward in its outlook on new materials and techniques; manufacturers with failure to adopt new marketing methods and attempts to control the markets in their products; labor with obstructionism; and law-makers with framing unintelligible and archaic requirements that act to "strangle" construction.

As remedies, it suggested a reorganization of the building industry that would place emphasis on mass-production, or at least shop-fabrication; a general revision of building codes and zoning laws to make them flexible and less restrictive to new methods and materials; and a relaxation of the jurisdictional claims of many building-trades unions.

Study year old

The NAM study had its origin more than a year ago, when the special committee was appointed. Utilizing the services of Corwin Edwards, professor of economics at Northwestern University, and Miles Colean, Washington, D. C., as researchers, the committee itself made lengthy studies of basic factors in the industry for presentation to the NAM board of directors for their further action.

Reorganization needed

Central theme of the report is the insistence on the need for reorganization of the construction industry from its present small-operator status to one comparable to other major industries, which its dollar-volume of business even now equals or overbalances. "The construction industry proper is one of the most striking areas of small-scale enterprise, and, although it appears well adapted for competition, it contains some restrictive practices which have been possible primarily because of localized markets and diffused responsibilities," the committee said.

"It is rare for any one party to assume, from the standpoint of the ultimate consumer, full responsibility for the proper erection of a house in the sense that a single concern is responsible for making an automobile. As a consequence, no single activity has a very large effect on the final cost of a completed structure. As a consequence . . . . it is reasonable for each group to think that there is a fixed amount of work to be done in supplying a fixed demand . . . . and that high prices and practices that raise charges for that work necessarily must be profitable.

". . . The construction industry thus comes to be based on a relatively small volume, with activities tending to be entirely upon a segregated local basis and some resultant practices designed to exclude out-siders and . . . . eliminate competition."

(*Continued on page 89*)

Construction hits high for postwar period

Civil engineering construction volume hit a new postwar high during the 5-day week ended Dec. 4, when a total of $214,014,000 was recorded by the *Engineering News Record*, Business News Department.

The figure was the highest recorded in any week since November, 1942, and was 83 percent above the previous week and 103 percent above the corresponding week in 1946.

Of the $214,041,000 total, $137,329,000 was credited to private construction. Public construction accounted for $76,685,000.

According to this journal's statisticians, total engineering construction for the 49-week period of 1947 totals $5,369,862,000, which is nine percent above a similar period in 1946. This latter figure breaks down to $3,032,763,000 as a cumulative total for private construction, and $2,337,099,000 for public construction. Of the public work, state and municipal building accounts for $1,746,525,000, and federal work for $590,574,000.

Housing starts will top 850,000 for full year

Apparently bearing out earlier predictions of a boom year for housing (*ENR* Sept. 18, vol. p. 374), some figures compiled by the Department of Commerce Bureau of Labor Statistics now indicate that more than 850,000 new dwelling units will have been started by the end of 1947.

BLS reports showed that during the first ten months of the year, 658,000 units were completed—50 percent more than in the entire previous year—and completions during the last three months have followed a steady, contra-seasonal upturn, rising at the rate of about 8 percent a month. In October, the latest month for which the organization had complete figures, 81,800 completions were reported.

During November, an estimated 80,000 units were started, and preliminary estimates for December place starts for that month at about 70,000.

If these figures are borne out, the total for 1947 should be more than 850,000—the best home construction year since 1925, officials said.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public construction — Specifications for the 200-bed general medical Veterans Hospital at *Fort Wayne, Ind.*, have been completed . . . Bids will be received Dec. 23 on the 15-story Mississippi state office building at *Jackson.* . . . The *Bryn Mawr, Pa.*, Hospital has plans for $1,000,000 worth of construction . . . *Georgia* will spend $44,500,000 on a hospital expansion program over the next five years . . . Fifteen additional buildings and six connecting corridors—amounting to about 5,400,000 cu.ft. of construction—are planned at the Veterans Administration hospital in *Lebanon, Pa.* . . . Contracts have been awarded for a $1,367,466 junior high school in the Shoreline district at *Seattle, Wash.*

Private construction — Witco Chemical Co. has started construction of an asphalt processing refinery in *Perth Amboy, N. J.* . . . City Line Center, Inc., *Ardmore, Pa.*, has let contracts of $11,250,000 for a theater and store development . . . Construction will start next month on the $1,000,000 Texas & Pacific Ry. freight terminal at *Dallas, Tex.* . . . Contracts have been awarded to S. N. Nielsen Co., Chicago, by the Chicago and North Western Ry. Co. for a diesel locomotive servicing and repair shop near Kinzie street and Pulaski Road, *Chicago, Ill.* . . . A $7,000,000 expansion program for the *Hutchinson, Kan.*, area has been announced by the Kansas Power & Light Co.

Housing — Plans for an apartment development in the Riverdale section, *N. Y. City*, to house 3,000 families at an estimated cost of $39,000,000, have been disclosed by the Hudson Manor Gardens, Inc. . . . M. Shapiro and Son, Inc., New York City, will build a $6,000,000 apartment development near *Wilmington, Del.* . . . The CIO council of Hennepin County has asked the city council of *Minneapolis, Minn.*, to spend at once the balance of a $2,000,000 bond issue already floated for prefabricated houses and to raise another $2,000,000 for permanent housing . . . Hyman Korman, Inc., will build two new residential projects in *Philadelphia, Pa.* to cost $1,250,000 . . . D. P. McKenna will build a $2,000,000 development at *Llanerch, Pa.* . . . A permit to build 39 brick veneer apartment buildings for 364 families at *Louisville, Ky.*, has been granted to Roy Highbaugh Jr. . . . Forestgate, Inc., is advertising 5,699 apartments for sale to veterans only in a group of 21 buildings of 14 stories to be erected in *Forest Hills, N. Y. City.*

Water supply and sewers — Plans for the modernization of the water system in *Erie, Pa.*, will be ready early next year, according to John D. Johnson, water bureau superintendent. . . . *Cheektowaga, N. Y.*, will have plans prepared for a storm sewer system . . . A water supply and distribution survey for *Middletown, Conn.*, will start soon . . . *Boise, Idaho*, has approved a $1,555,000 bond issue for a sewage disposal system . . . *Great Falls, Mont.*, has approved a $1,300,000 issue for sewers . . . City council of *Akron, Ohio*, has ordered $600,000 in bonds to be issued for improving the Kent pumping station . . . Work has started on a $1,000,000 water filter plant at *Phoenix, Ariz.* . . . Board of Works, *Evansville, Ind.*, has accepted plans for a $1,325,453 east side intercepting sewer system . . . No bids were received for the main sections of the *South Omaha, Neb.*, sewer, it is said because contractors would prefer to wait till spring . . . *Dallas, Tex.*, has spent over $10,000,000 in the last two years in expanding its water and sanitary sewer systems city officials reported.

New anti-pollution law is sought for Ohio

Proposed legislation has been drawn up by the Ohio State Board of Health to make it unlawful for any Ohio city, village, county, public institution, or political subdivision to discharge sewage or other waste into streams. Violators would be subject to fines of $100 to $500 for each offense. If pollution of a stream continued after conviction, the offender would be liable for a separate fine for each 30-day period of continuing violation.

The bill would permit action by the state against violators on request of district health authorities in counties having jurisdiction over offenders.

Fred Warring, sanitation engineer for the State Board of Health, said Ohio must pass the pollution bill to live up to an 8-state pact establishing the Ohio River Valley Sanitation District. The act has been ratified by all states except West Virginia.

The proposed Ohio bill was drawn after examination of present state health laws showed that pollution of streams must actually exist before action can be taken.

N.W. power shortage may reduce lights

Facing a shortage of hydroelectric power due to a recent prolonged drought, the Northern States Power Co. has asked all residents of Minneapolis, Minn., and the area from LaCrosse, Wis., to Sioux Falls, S. D., to use less electricity in their homes from 4 to 6 p. m. each working day.

President B. F. Braheney of the firm said that steam equipment to fill the gap cannot be obtained in time. "Earlier this year, we expected to have at least 12,500 kw. of new generating equipment operating by this time," he said. We had equipment with capacity of 50,000 kw. on order, but delivery was delayed. Now we know that even the expected 12,500 kw. of steam equipment will not be here in time to be ready for operation to meet the pre-Christmas demand."

H. C. Cummins, vice-president, said it is likely the company will make an appeal to its 375,000 residential customers in 600 communities to hold down their use of electricity between 4 and 6 p.m in order to spread the available power supply.

New annual award announced by ASCE

Establishment of a new annual award in honor of the late James W. Rickey, former hydro-electric engineer with the Aluminum Company of America, has been announced by the American Society of Civil Engineers. Col. William N. Carey, executive secretary, said the organization has accepted the offer of Mrs. Lucy M. Rickey, Washington, D. C., to establish a sum of $16,500 to perpetuate the memory of her late husband.

For hydro-electric work

The award, to be known as the Rickey Medal, will be a gold medal and an engraved certificate. It will be bestowed for papers in the field of hydro-electric engineering, including any of its branches, which are deemed to constitute an outstanding contribution to the art, with consideration both for the usefulness of the subject matter and the form of presentation in "Transactions", the technical publication of the society. The award will be open to non-members, as well as members of the ASCE.

Mr. Rickey, who retired Jan. 1, 1938, had been active in the society since 1902, and had been an officer of the society's power division, whose executive committee will judge the papers for eligibility for the medal.

NSPE meeting told need of recognition of status for younger engineers

National Society of Professional Engineers to launch campaign to raise status of profession for young men

The need for proper recognition of young engineers and engineers-in-training to emphasize the professional importance of their entry into the engineering field received primary attention last week at an annual meeting of the National Society of Professional Engineers.

Meeting at Buffalo, N. Y., the group also adopted a series of resolutions urging greater recognition of engineers by the nation's armed forces. Alex Van Praag Jr., consulting engineer of Decatur, Ill., was elected president, succeeding Ritchie Lawrie Jr., of Harrisburg, Pa.

Keynoting the theme of the importance of young engineers, Mr. Lawrie told the group that through its Committee on the Problems of the Young Engineer, the NSPE is now embarking on a program to bring proper recognition of the true importance of younger men. "The improvement of the professional stature of these men will increase their value to both industry and government," Mr. Lawrie declared. "Men of sufficiently high caliber can be attracted only if the social prestige of the profession is increased and if their professional status is recognized and assigned its true value."

Attacking the problem from another angle, in what he said might be termed "Industry's viewpoint of engineers", Harry A. Winne, vice-president of the General Electric Co., warned that young engineers should concern themselves primarily with the opportunities offered by industry, rather than solely with questions of tenure and pay. "The only security a young engineer should worry about, "Mr. Winne told his listeners," is security of opportunity."

Allen R. Cullimore, president of Newark (N. J.) College of Engineering, said that in the next several decades, engineering activities must be broadened to include more recognition of human and business relationships in engineering. "Viewing the problem from the standpoint of an educator," he said," engineering requirements of the need for greater coordination of our distribution systems, . . . rail, air, water, highways and pipelines must be emphasized in our colleges."

"Young engineers, in the main, are not sufficiently interested in management or in the operation of engineering projects at a profit. Too many believe that the farther they can keep away from politics, profit and people the higher will be their professional standing. This attitude . . . often relegates the engineer to a secondary place in community life."

The society's committee on military affairs, headed by Col. W. A. Hardenburgh, now editor of *Public Works* magazine, warned the group that apparent lack of recognition of engineers as professional men by the Army and Air Forces may result in an inadequate supply of over-all engineering leadership in these branches in any future emergency.

ALEX VAN PRAAG JR.
New President of NSPE

The committee recommended the assignment of an engineer-in-chief for all the armed forces to the staff of the Secretary of National Defense; a careful study of sources of supply and methods of procurement during a national emergency, and the establishment of an adequate over-all engineering group for the Air Force, on a status parallel to that of the Corps of Engineers in the present Army organization.

In a resolution, the society urged that all appointments and commissions in the combined Army and Navy organizations, requiring "responsible exercise of technical engineering knowledge" be filled with registered professional engineers.

A highlight of the two-day meeting was a report on activities of the Bureau of Reclamation by Kenneth Markwell, assistant commissioner. Mr. Markwell told the organization that "the engineer today has both a technical and moral responsibility to use his professional skill to open up and make possible the exploitation of basic resources inaccessible in their natural state." Commenting that this development is now lagging "critically" behind the needs of western states, he added that the rates of compensation must be made more attractive if the bureau's engineering jobs are to obtain high calibre men willing to make such work a career.

Officers and resolutions

In a series of resolutions, the NSPE urged:

A uniform system of center-stripping highways in the interest of national safety, and an "adequate national system of coordinated highways designed to carry heavy military equipment; federal engineering aid to foreign countries—but only if enabling legislation will bar the actual designing, planning, supervision or construction of foreign projects by the U. S. government or its employees; establishment of a National Science Foundation, and the adoption of legislation to expedite the abatement of stream pollution.

The society strongly disapproved the creation of any national clearing-house for technical information on the ground that such legislation would place the government or its employees in the status of technical consultants to individuals or business corporations.

Other officers elected were: Russel B. Allen, professor of civil engineering, University of Maryland, re-elected treasurer; Paul H. Robbins, re-elected executive director; vice-presidents—William Ryan, Boston, Mass; Lawrence Peterson, Milwaukee, Wis.; Robert Coltharp, Austin, Texas, and A. J. Shaver, Reno, Nev.

A report showed that membership in the society passed 17,000.

Consulting engineer group names new secretary

Rear Admiral R. E. Bakenhus (CEC, USN, ret.) New York City consulting engineer, last week was named as secretary of the American Institute of Consulting Engineers, to succeed the late Philip B. Henry.

Adm. Bakenhus, president of the organization in 1943, and once was acting chief of the Navy's Bureau of Yards and Docks, will move his own offices to the institute's headquarters at 75 West Street, as of Jan. 1.

Membership in the institute is open to consulting engineers who are members of any of the founder societies, and to officers of the Army and Navy engineer organizations.

N. Y. state schedules biggest road letting

Lifts 40-hour work-week limit to speed highway building—Other states report action on road construction programs

Planning the biggest combined highway contract letting in its history for mid-December, the New York State Department of Public Works topped highway construction news last week.

New York also announced that as a means of putting its highway contractors on a par with other constructors in competition for skilled labor, it had lifted a statutory 40-hour work-week limit on some 110 highway projects. Under legislation passed last April, the state industrial commissioner is empowered to declare certain highway work as "critical" to permit longer work-weeks.

The state set Dec. 17 for calling of bids on some $25,000,000 worth of highway projects. These jobs will include paving of a 21-mi. extension of the Taconic Parkway, from its present terminus in Dutchess County toward Lafayetteville; construction of a grade separation structure and two girder bridges on the Bronx River Parkways.

Additionally, state officials announced the award of a $1,454,600 contract to County Asphalt, Inc., Mt. Kisco, for a 4.11-mi. extension of the Saw Mill River Parkway from Chappaqua to Mt. Kisco.

Other states plan

Meanwhile, many other states continued to report large-scale contract lettings and plans for future work, as they strive to cope with increasing highway travel over roads virtually unimproved since before the war.

An example of the problem facing administrators was given by John H. Lauer, chairman of the Indiana State Highway Commission, who reported that traffic on Indiana highways in October was up 12.1 percent over the same month of 1946. Mr. Lauer said the gain is 8.3 percent above the figure for October, 1941, taken as the last year of prewar normal conditions.

The Pennsylvania Department of Highways needs $647,000,000 to modernize 2,300 miles of state roads, complete the surfacing of dirt roads now in the system, build new bridges and pay property damage, according to E. L. Schmidt, chief engineer

He also said that the department has less than one-tenth of the money it needs for road improvements, pointing out that of the $157,000,000 available from motor fund receipts, the department needs $84,000,000 for administration, engineering, maintenance, snow removal and operation.

In Massachusetts, a special legislative committee found that the state needs $677,000,000 for the construction and repair of highways and bridges, over a 10-year period. The Boston metropolitan area needs $325,000,000 for the construction of arterial traffic lanes. Of the existing state highways, 53 per cent are from 10 to 20 years old. Within the 10 years required to put this program through to conclusion 127 bridges will require rebuilding.

Important parts of the Connecticut Highway Department's 1948 construction program include the proposed Shelton-Derby by-pass which will include a $2,000,000 bridge over the Housatonic River and a $200,000 viaduct over the railroad tracks. An expenditure of $1,200,000 will be required for dual-lane highway Route No. 8 through Seymour and Beacon Falls.

A new railroad overpass will be built near the Windsor-Hartford line for $410,000. In Hartford a railroad tunnel north of Morgan Street will cost $505,000 and relocation of a part of the freight yards $500,000. A bridge will be built over the Willimantic Division tracks at a cost of $175,000.

Three contracts totaling more than $818,263 have been awarded by the Arizona State Highway Department for road improvement and bridge construction. The largest of the three is for construction of new bridges over the Agua Fria and New rivers on the Phoenix-Prescott highway and was awarded the Lee Moor Construction Co. of El Paso, Tex., on a bid of $327,459.

N. L. Smith may serve Baltimore city-county

Nathan L. Smith, 59-year-old engineer who is retiring as director of the Baltimore, Md., Department of Public Works, is a Republican, but has been offered top engineering posts by the Democratic City and County administrations.

Mr. Smith, a civil engineering graduate of Swarthmore College, has accepted a municipal position as engineering consultant while he has also been offered the office of chief engineer of the metropolitan district of Baltimore County. The county post, should he accept it, would become available to him on Jan. 1, next, the day after he gives up his present full-time city position. It is believed that eventually Mr. Smith would be made head of a new over-all public works department, now in the early stages of formation. Authority to set up such an agency was granted by a recent session of the Maryland General Assembly.

Improve roads parallel to Penna. Turnpike

State policy favors local motorists by not neglecting nearby free highways

Following an established policy not to neglect improvements on free roads paralleling the Pennsylvania Turnpike, the State Highway Department during the last year has started improvement projects totaling more than $6,000,000 on Route 22—the William Penn Highway between Harrisburg and Pittsburgh.

Governor J. H. Duff has repeatedly emphasized that toll roads must not be promoted at the expense of motorists by neglect of parallel free highways.

The most recent project on Route 22, on which a low bid of $1,639,705 was received by the department, is the elevation and widening of about 2.5 miles on the highway near Harrisburg. This project includes elimination of a hazardous railroad underpass and the construction of an overhead bridge to replace the underpass. The work includes 580,896 cu. yd. of fill to bring the roadbed above flood stage where it parallels the Susquehanna River. In addition, 530,916 cu. yd. of cut will provide for relocation of railroad tracks along the mountainside.

The present 2-lane highway will be rebuilt as a 4-lane road.

In addition to this project, four other major ones are under way on Route 2 between Harrisburg and Pittsburgh. A fifth, bringing the total expenditure on the William Penn Highway this year to more than $6,500,000 is located in Lebanon County, although this job does not parallel the Turnpike.

A survey for further improvements to 35.5 miles of Route 22 east of the Lebanon-Berks County Line is currently being made for the Highway Department by Michael Baker, Inc., of Rochester, Pa.

Gen. Weart joins board for rivers and harbors

Brig. Gen. Douglas L. Weart, Ohio River division engineer at Cincinnati, Ohio, has been appointed to the Corps of Engineers' Board for Rivers and Harbors. He replaces Col. George W. Gillette, division engineer of the South Atlantic division at Atlanta, Ga., who is retiring from the Army to become executive director of the North Carolina State Ports Authority (*ENR* Dec. 4 vol. p. 779).

The appointment does not affect General Weart's position as Ohio River division engineer.

Report scores construction industry

(*Continued from page 85*)

Turning to a section-by-section analysis of the industry, the committee made these specific charges and suggested specific remedies:

The manufacturer: "The various local elements that comprise the construction industry have in some cases sought to eliminate competition by attempting to segregate the local market and retain local jurisdiction in . . . their particular sphere. The established groups have in a number of instances made common cause against innovations . . . ."

The distributor: "The building material dealer has in some instances followed restrictive practices in order to maintain his place in the channel of distribution . . . . (and) to enhance his operating margin. . . . He has sometimes attempted to restrict development of new types of distribution methods—such as mail-order houses—and in some cases has also tried to keep the local market isolated and continue construction activity at the job site."

The contractor: "Generally speaking, the contracting groups have also shown some tendency to try to reserve the local market for themselves as against outside contractors, or contractors who have been engaged in closely related lines.

Labor: "Has participated in commercial restrictions and collusively used its bargaining power to get union recognition. . . . Has participated in promoting localized work, preventing prefabrication and fixing prices. . . . Has followed a pattern of restrictive practices . . . designed to prevent the use of cheaper materials, improved equipment or more efficient methods. . . .Has restricted the amount of labor available. . . . Has compelled the hiring of useless and unnecessary labor. . . . Its complex organization of craft unions has resulted in substantial restrictions on the efficiency of the construction process. . . ."

Specific remedies

"Where the manufacturer, distributor and contractor have been engaged in interstate activities, restrictive practices are controlled by the federal anti-trust laws. The NAM has consistently favored continuous, honest enforcement of these laws and continues to do so.

"There is need, however, for more systematic and uniform use of state anti-trust laws to prevent restrictions in the construction industry.

"This need exists," the report continued, because many local restrictions lie outside the jurisdiction of federal law and because federal enforcement cannot be adequate in scope. A considerable number of states now have anti-trust laws, but many do not, and the effectiveness of the law in certain of the states is impaired by gaps, difficult legal procedures and haphazard enforcement. Moreover, the state legislation is so varied in character, scope and effectiveness as to provide no . . . solution for the nation-wide problem of local building restraints.

"The only adequate means to cope with localized restraints would be a system of state anti-trust laws adequately enforced. A model state anti-trust law should be developed."

As to labor, the committee noted that the labor section of its report was drawn up before the passage of the Taft-Hartley Act, but its recommendations centered upon legal restrictions on the closed shop, the secondary boycott, and similar matters. It called for "outlawing" of any union practice that seeks to restrict materials, trade or production, and of juri-dictional strikes. In another section, "intelligent" labor cooperation to prevent strangulation of the industry, was asked.

Pan American Airways photo

***To Aid Turkey**—Harold E. Hilts, deputy commissioner of the Public Roads Administration, and Vecdi Diker, highway engineer for the Turkish Ministry of Public Works, confer before leaving by plane for Ankara. Mr. Hilts will head a delegation of U. S. engineers who will assist the Turkish government in modernizing its highway system (ENR Dec. 4, vol. p. 765).*

Legal obstacles

Calling attention to the fact that there are now some 1,300 local building codes in existence—at least 10 percent of which are 30 years old or more, and 40 percent between 15 and 30 years, the committee devoted an entire section to a review of restrictive building laws and possible remedies.

The report cited the fact that in different codes, the required working stress of structural steel differs from 16,000 lb. per square inch to 20,000 lb.; the live-load that must be borne by a dwelling floor ranges from 40 lb. per sq. ft. to 100 lb.; and concrete fireproofing thickness varies from 1½ in. to 5 in.

"The restrictions for which these laws are responsible fall into two classes—one inadvertent, one deliberately planned," the group said.

"The inadvertent restrictions are the result of the fact that the laws in this field are enacted locally, often without adequate knowledge . . . and are seldom revised. The wide variations . . . create obstacles to mass production and to the development of centralized prefabrication of portions of structures. Variations in licensing requirements discourage the movement of contractors, and tend to assign construction activity to local workmen and enterprises. . . . Excessive requirements of codes also tend to make construction unduly costly by their insistance on costly materials and methods of erection.

"Direct restrictions, including those imposed by too-specific requirements for materials and tests, also include the licensing provisions that limit competition, and requirements that limit or establish a preferential status for local methods and enterprises. Subdivision, land-use, planning laws and zoning ordinances . . . . also act as restrictions because they are . . . not coordinated."

Legal remedies

As remedies, the group called for repeal and revision of measures that "are not necessary for the protection of the public but merely serve as restrictive devices"; repeal of local preference provisions; repeal of provisions for licensing contractors, since building codes and other laws control performance; and the introduction of performance-standards as the basis for approval of materials and methods.

In a final paragraph, the group warned lawmakers to keep their building laws simple, to make them easily understood by the public and the building industry.

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

Milwaukee discusses plan for $8 million lakeshore highway improvements—Salt Lake City balked in winter sports area plans because of watershed considerations—Courts approve "rent-purchase" contract for Jacksonville, Fla., incinerator

Seeking to untangle their city's snarled traffic conditions, Milwaukee, Wis., common councilmen last week had approved a proposal for the construction of a $5,000,000 bridge across the Kinnickinnic River at Greenfield Ave., in the downtown area. The bridge would be a part of a highway system to tie the business area to the Lake Michigan waterfront.

In a series of resolutions, the council approved the use of $3,000,000 of funds set aside for lake shore improvements to pay the city's share of the bridge project, and instructed Walter M. Swietlik, commissioner of public works, to proceed with preliminary steps.

Other cities continued to push their plans for relief of traffic congestion. Reported action included:

At Baltimore, Md., where city officials are hurrying to meet a deadline in order to qualify for some $4,000,000 of federal-aid money, city councilmen eliminated a 4-mile section of a proposed expressway through the northeast sector of the community. The section —not planned for construction for at least 10 years—had been the subject of controversy in council hearings on construction of a road to bisect the city from northeast to southwest.

Little Rock, Ark., officials were considering recommendations contained in a traffic report prepared for them by H. W. Lochner of Chicago, and L. A. Henry and Max Muehlburger of Little Rock, consulting engineers, who were called in to recommend a solution of the city's traffic problems.

Memphis, Tenn., decided to hire an outside engineer to make a citywide traffic study; and at Montreal, Que., Mayor Camillien Houde said that the city has prepared plans for two east-west express highways, and added that plans for subways and street widening were in preparation.

Affirm purchase method

In a decision that legal experts said might have far-reaching effects on city financing methods, the Florida State Supreme Court last week had declared valid a "rent-purchase" contract by which the city of Jacksonville proposes to obtain two new incinerator units without issuing bonds or certificates of indebtedness.

The city proposed to enter into a contract with the Nichols Engineering and Research Corp. under which the company would erect the two units, and the city then rent the equipment at an annual rate of $31,074. At the end of 15 years, the units would become city property, or the city would have the right to purchase them outright for a fixed price of $381,000, less any amount paid as rentals.

Suit to test the validity of the contract was brought by the city and a representative of the contractor.

Balk sports area plan

Salt Lake City's hopes of developing the nearby Alta-Brighton skiing area into a major winter sports resort sustained a setback recently, when the U. S. Public Health Service recommended that all further developments on the Wasatch Mountains be halted in the interest of preventing water pollution.

Alta is located on Little Cotton[wood] Creek, and Brighton on Big Co[tton]wood Creek, both of which are sources for the city's water supply.

The report specifically recommended that the further construction of hotels, resorts or developments with water carriage sewage systems be prohibited on the canyon watersheds, and said that while sewage treatment plants at the proposed recreation areas are feasible from an engineering standpoint, they would still provide a potential danger to the water supply.

Water problem

Rather than build a new sewage treatment plant at a cost of more than $1,000,000, officials of Raleigh, N. C., offered to build a new source of water supply for the neighboring community of Smithfield.

Smithfield officials have made repeated protests because Raleigh dumps raw sewage into the Neuse River, Smithfield's water supply source. Raleigh councilmen, citing the fact that there are no funds at present for a new treatment plant, and that if a bond issue is decided upon, nearly two years must elapse before action is taken.

Fairchild Aerial Surveys photo

***Village Left Out**—A road relocation project supervised by New York State will completely by-pass the village of Roslyn (a New York City suburb) by means of a 2,144-ft. viaduct cutting across a shallow valley and bridging the upper end of Hempstead Harbor. The new link will eliminate about two miles of narrow winding, two-lane road looping through the village itself. Fourteen concrete piers varying up to 45 ft. high will carry the viaduct, with spans ranging from 99 ft. to 226 ft. Senior and Palmer, New York City, are general contractors.*

Panama Canal report details costs of alternate modernization plans

Special board studied many schemes before recommending $2.5 billion to a sea-level canal conversion

The report of a special board of consultants on the Panama Canal, submitted to Congress by President Truman Dec. 1 (*ENR* Dec. 4, vol. p. 765), discloses that costs of four major plans for canal rehabilitation vary from $130,000,000 to the $2,483,000,000 for the recommended sea-level canal.

Based on a comprehensive study that started in 1946, the report has already received the approval of the Joint Chiefs of Staff and Navy Secretary Sullivan. It stresses the likelihood that "beginning about 1960, the (present) canal will be unable to meet the demands of inter-ocean commerce without inflicting delays that will become increasingly more serious to shipping as further traffic increases are realized."

Many routes studied

The detailed study of how best to improve the waterway was carried out in accordance with Public Law 280 of the 79th Congress, approved Dec. 28, 1945. A special engineering division headed by Col. James H. Stratton as supervising engineer was established and some 30 canal routes—from the Isthmus of Tehuantepec in Mexico to the Atrato River region in Colombia—were studied (*ENR* May 1, vol. p. 740).

This study disclosed that the Canal Zone is the most suitable location for an Isthmian canal but that the present canal is vulnerable to modern weapons of war of even moderate size.

If considerations of security and the need for transiting the largest naval vessels were disregarded, the existing canal could be modified, at an estimated cost of $130,000,000, to provide for the needs of inter-oceanic commerce until the year 2000 by completing the suspended third locks project, the report states. However, it points out that this project, which was designed to overcome the deficiencies of the capacity by construction of a third lane of larger locks, would be inadequate from the security standpoint.

Costs listed

Reconstruction of the existing canal with a Pacific terminal lake to meet the future needs of commerce and to pass the largest ships expected in the remainder of the century, without satisfying the needs of national defense, would have an initial cost of $1,126,000,000, it is estimated. The ultimate development in accordance with this plan is estimated to have a total final cost of $1,632,000,000.

The plan calling for construction of two new lanes of locks with one pair at Gatun and the other at Miraflores and with the locks at each widely separated to reduce the probability of simultaneous destruction is estimated to cost $2,308,000,000. With this project one of the locks at each location would utilize the excavation already completed for the third locks project. Not only is this plan described as costly, but the canal improved in this manner is classified as a vulnerable structure in wartime.

"Despite the maximum protection that feasibility could be given the locks and lock gates, they could be damaged so severely by sabotage or weapons using conventional explosives that Gatun Lake would be drained and the canal rendered inoperative for periods up to two years," the report said. "The destruction and lingering radioactivity resulting from atomic bombing could put the canal out of service for a much longer period. Thus, no lock canal would meet the future needs of national defense."

Conversion of the existing waterway into a sea-level canal was found practicable by the investigating groups. Serious earth slides could be prevented with this plan, as well as with the other improvement projects studied, by appropriate flattening of the bank slopes, it was reported.

Other advantages cited for the sea-level project include: "Such a canal would have adequate capacity. It would not be destroyed by any known weapon and only the atomic bomb could cause temporary interruptions to traffic. Navigation through an uncontrolled Panama Sea-Level Canal would be entirely feasible; however, the tidal currents should be regulated for added safety to shipping. Tidal-regulating structures would consist essentially of a tidal lock, and a navigable pass which would be opened to traffic during mean tidal stages. In wartime, the gates of the pass could remain open, or, if destroyed when closed, could be removed within a few days and the canal operated as an open waterway."

The sea-level canal would follow generally the alignment of the existing waterway in the regions of deepest cut. Elsewhere the alignment would take advantage of the most suitable terrain in meeting the required standard of curvature. The channel would have a depth of 60 ft. and a width of 600 ft.

Excavation for the sea-level waterway would total 1,068,670,000 cu. yd. of material, of which 15 percent would be hard rock, 27 percent medium rock, 33 percent soft rock, and 25 percent earth. About 11 percent of the length of the project would involve cuts deeper than 250 ft. and the deepest cut would be about 600 ft.

Name Col. W. F. Heavey to N. Y. docks agency

Col. William F. Heavey, retiring district engineer at New York City for the Corps of Engineers, will take over the newly-created post of consulting engineer to the New York City Department of Marine and Aviation.

In announcing the appointment, Mayor William O'Dwyer said Col. Heavey would be "particularly concerned" in the extensive waterfront rehabilitation plans now being considered by the city.

A 1917 West Point graduate, Col. Heavey last year received the distinguished Service Medal for his achievements during the war when, as a brigadier-general, he commanded the Second Engineer Special Brigade, which made many assault landings throughout the Pacific war theater. He received a civil engineering degree from Massachusetts Institute of Technology in 1922.

Northern Pacific Ry. opens New Salem cutoff

The Northern Pacific Railway's New Salem cutoff in western North Dakota —the company's most extensive line relocation in three decades—is scheduled to be in use this week, according to W. W. Judson, vice-president of the operating department.

All main-line trains will be operated over the new 16½-mile line, completed at a cost of $2,750,000.

The project, one of the largest of its kind completed in recent years, involved handling 3,750,000 cu. yd. of earth. Begun in April, 1946, the grading was completed in October last year, but inability to obtain steel for five bridges delayed completion.

The old line runs south from New Salem to Aumont, then northwest to Glenullen. The new line, which starts at New Salem, 28 miles west of Mandan, runs straight west, reducing the mileage 9.3 miles.

Inter-agency group urges larger Pick-Sloan plan

The Missouri Basin Inter-Agency Committee, meeting at Pierre, S. D., last week, took active steps to promote public understanding and support of what amounts to an enlarged Pick-Sloan plan for the development of the Missouri River valley.

The committee will urge states in the region to include broad programs of their own to be incorporated in a coordinated federal-state development of the basin in connection with the congressionally-approved Pick-Sloan plan.

Authorized instructions to a subcommittee, which will meet in Omaha, Neb., Jan. 5 to integrate the various proposals submitted at the 2-day meeting at Pierre would permit the inclusion of state-sponsored plans covering projects in addition to flood control, navigation, reclamation and irrigation.

These other phases would include agricultural programs, specific studies, or investigations, highway and airport modifications, game and fish protection, forestation, administration and promotion of land and water resources development, construction and maintenance of irrigation, power, flood control or similar projects, and stream pollution problems involved in carrying out the proposed federal programs.

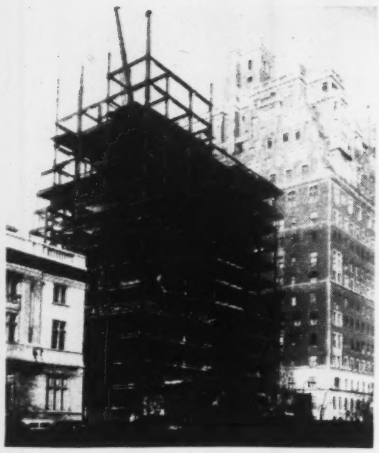
Governor Donnelly of Missouri took the lead in efforts to liberalize the scope of activities and in demanding joint federal and state participation in the various functions to be performed. He called for combined state and federal expenditures of $392,420,918 over the next 6 years in his state alone.

Gov. Sam C. Ford of Montana, who had objected to the inclusion of highway programs in the states' plans, was satisfied with an amendment offered by Governor Donnelly providing for certain highway and airport modifications.

Brig.-Gen. L. A. Pick, who spoke in favor of the larger plan, told the committee that there ought to be a definite indication of the funds the states plan to spend out of their own resources, since, as a rule, when some problem is handled cooperatively with the state in the federal basin program, it can be expected that it will cost the state money."

The work of the Inter-Agency Committee at present is largely one of educating the public and acquainting Congress with necessary projects.

The 6-year program, submitted tentatively by the committee and to be presented to Congress after another meeting at Lincoln on Jan. 22, will call for total federal expenditure of well over two billion dollars.



Quick Rental—More than 60 percent of the 95 suites in the first postwar deluxe rental apartment building to be built on New York's Park Avenue are now rented, according to Sam Minskoff and Sons, builders. The 19-story-and-penthouse, steel-frame structure will feature suites of three to seven rooms, with concealed radiation, extra-wide windows with special ventilating panels, individual balconies, and other luxuries. Sylvan Bien, New York, is architect.

Houston tunnel bids far over estimate

Bids for construction of the vehicular tunnel beneath the Houston Ship Channel near Pasadena, Tex., (*ENR* Oct 23, vol. p. 563) exceeded by more than $2,000,000 the original estimate for the project, officials said after reviewing bids opened in the Harris County commissioners court, Houston.

The project had been divided—for bidding purposes—into four sections: the tunnel proper, the approach roads, electrical equipment and ventilating equipment. The sum of the lowest bids for each section was $7,376,275.42. About a year ago it had been expected the work could be done for about $5,000,000.

The bids were referred to the Mobile, Ala., engineering firm of Palmer and Baker for analysis.

Bids are due Dec. 17 on Delaware bridge piers

The Delaware State Highway Department has called for bids on tower piers and east and west anchorage foundations for the $25,000,000 high-level bridge to be built between New Castle County, Del., and Salem County, N. J. Bids are due Dec. 17 at 2 P.M. and returnable in Wilmington, Del., the department said.

Cleveland lets contracts for intake and tunnel

On Nov. 22 a contract for construction and placing of about 18,000 ft of concrete water intake pipe under the bed of Lake Erie, and an intake crib was awarded to Merritt, Chapman & Scott Corp., Cleveland, Ohio on a bid of $4,261,842.

At the same time, a contract for the construction of a mile-long tunnel to connect with the intake pipe at the shore line and to extend to a yet-to-be-built filtration plant, was awarded to the Kalill Co., Cleveland, on its bid of $1,844,739.50.

Awarding of the two contracts is the first big step taken by Cleveland to augment its water supply through construction of a complete water pumping and treating plant for the Nottingham District.

On the marine section, the intake is to be laid in a trench scooped out of the lake bed 60 ft. below the surface. Reinforced concrete pipe, to be cast on a site adjacent to the project, in 24-ft. sections, 10 ft. in diameter with 10-in. walls, will be lowered into the trench. Divers will do the jointing work.

The tunnel, to extend from the shore line about one mile to the site of the new filtration plant will be of concrete and poured into the underground forms about 50 ft. below the surface through holes drilled for that purpose.

By the time the tunnel and intake work is completed present plans call for work on the filtration plant to be well under way. It is thought at this time to have the Nottingham water project completed by late 1950 or early 1951. Havens and Emerson, consulting engineers, employed on the project since its inception, will continue as consultants through its construction.

Award $26.4 million Clark Hill Dam contract

Allstate Constructors, Inc., 1 East 43rd St., New York City, have been awarded the contract for the construction of the main dam for the Clark Hill multi-purpose project on the Savannah River near Augusta, Ga.

The contract was officially awarded by Col. Paschal N. Strong, Savannah district engineer, following approval by the Chief of Engineers in Washington. The low bid by the company was $26,456,179.55.

Allstate Constructors, Inc., is composed of Walsh Construction Co., E. Perini and Sons, Ralph E. Mills, Blythe Brothers, Massman Construction Co., and J. A. Jones Construction Co.

OBITUARY

Arthur P. Button, 59, assistant to the chief engineer of the New York Central System, Chicago, died Nov. 29. He entered the service of the Central in 1909 as rodman at Albany, N. Y. Subsequently he worked as draftsman, assistant engineer and engineer of grade separations, in which capacity he went to Chicago in 1939, and on Aug. 1, 1945, was promoted to assistant to the chief engineer. He was a graduate of Rensselaer Polytechnic Institute, 1912.

Walter G. Sargent, structural engineer for G. Small and Company, before he retired in 1946, died Nov. 24 at his home in Reading, Mass.

E. B. Barnawell, assistant city engineer of Mobile, Ala., died in New Orleans, La., Nov. 25. He had formerly been sanitary engineer for the malaria control project in Pensacola, Fla., and later he aided in a similar project in Brazil.

Kenneth Davenport Alling, 44, sanitary engineer for the Stamford, Conn., health department, died Dec. 3. He was graduated from the Sheffield Scientific School of Yale in 1928 and shortly thereafter joined the Stamford engineering department as a sanitation engineer.

John Swain Godfrey, 53, secretary of the Middle Township Sewerage Commission and a retired construction engineer, died Nov. 11 at Cape May Court House, N. J. He was in government service for many years.

James B. French, 84, retired consulting engineer, died Dec. 2 in Jamaica, N. Y. City. A graduate of Cornell, 1885, he started as a rodman for railroads in Kansas and Texas and then became an assistant engineer for the Pencoyd, Pa., Iron Works. He became bridge engineer for the Chesapeake & Ohio Railroad, and later held similar positions with the West Virginia Short Line Railroad and the Long Island Rail Road. He also designed bridges for the New York, New Haven & Hartford Railroad. He held patents on a special type of bridge for transferring freight cars to and from barges.

Frank J. Pennell, 51, a civil engineer employed by Yonkers, N. Y., for 29 years, died there Dec. 2.

H. M. McCully, 61, head of the department of drawing and descriptive geometry at Carnegie Tech, died at Pittsburgh, Pa., Nov. 29. Professor McCully, a Carnegie graduate, 1915, had been a member of the faculty since 1918, and became known as an outstanding teacher, lecturer and author in his field.

Charles Van Amburgh, Sr., a former assistant New York State superintendent of highways, died recently in Binghamton, N. Y. For many years he was identified with New York State's good roads program. In 1918 he took over the third assistant's office in the highway department and supervised the construction of all town and county roads in the state.

Pierre Piche, 79, died recently at Terrebonne, Que. He was graduated at L'Ecole Polytechnique, Montreal, in 1892. He was first employed by the Shiffler Bridge Co., the Carnegie Steel Co. and the Cambria Steel Co. In 1908, he joined the Department of Railways and Canals in Montreal. From 1916 to 1920, he was in Quebec with the highway department. In 1920, he returned to the railways and canals department, where he devoted the last part of his career to maintaining, extending and improving the canal system of the Province of Quebec.

John Bancroft D'Aeth, 62, civil engineer, died at Three Rivers, Que., Nov. 25. He was a 1906 civil engineering graduate of McGill University. He had much construction engineering experience and at the time of his death he was chief engineer of the Dufresne Engineering Co. Ltd.

Dan Adams, 64, director of Lockwood Greene Engineers Inc., New York, died in that city, Nov. 29. Mr. Adams was born in Lowell, Mass., and was educated at the Massachusetts Institute of Technology from which he was graduated in 1906.

MAJOR MEETINGS

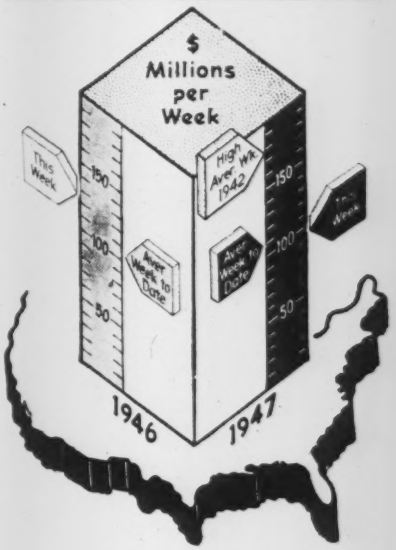
American Society of Agricultural Engineers, winter meeting, Stevens Hotel, Chicago, Ill., Dec. 15-17.

American Society of Civil Engineers, annual meeting, Hotel Commodore, New York, N. Y., Jan. 21-24, 1948.

Canadian Construction Association, 30th annual meeting, Chateau Frontenac, Quebec, Que., Jan. 25-28.

American Road Builders' Association, and its Divisions, annual meeting, Willard, Mayflower and Statler Hotels, Washington, D. C., Jan. 26-28.

CONSTRUCTION ACTIVITY



As Reported this week to... *Engineering News-Record*

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Dec. 11 1947	Cumulative 1947 (50 wks.)	Cumulative 1946 (50 wks.)
Federal	$28,808	$615,382	$295,438
State & Mun.	37,226	1,783,751	1,373,846
Total Public	$66,034	$2,403,133	$1,969,284
Total Private	29,589	3,062,052	3,086,214
U. S. Total	**$95,623**	**$5,165,185**	**$5,055,198**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (50 wks.)	Cumulative 1946 (50 wks.)
Waterworks	$1,742	$136,718	$106,331
Sewerage	3,556	170,381	111,196
Bridges	7,158	186,631	125,507
Highways	11,646	777,234	749,959
Earthwork, Waterways	27,920	314,484	325,117
Buildings, Public	9,450	577,649	400,694
Industrial	8,471	855,249	1,066,700
Commercial	19,294	1,830,875	1,824,940
Unclassified	6,386	636,264	345,054

NOTE: The sharp rise in construction costs would bring smaller projects into the *Engineering News-Record* reports and statistics than they were intended to include if the minimum values reported were kept constant. To continue reporting the same physical size of projects, the minimum dollar values were adjusted effective Dec. 1, 1947, in direct ratio to the *Engineering News-Record* Construction and Building Cost Indexes. Minimum dollar value of projects included were raised: Waterworks and waterway projects from $22,500 to $28,000; other public works from $40,000 to $50,000; industrial buildings from $55,000 to $68,000; other buildings from $205,000 to $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (50 wks.)	Cumulative 1946 (50 wks.)
NON-FEDERAL	$2,494,442	$1,591,007
Corporate Securities	1,125,960	590,868
State and Municipal	1,120,771	778,139
Fed. Aid Highway	247,711	225,000
FEDERAL	818,729	1,714,695
Total Capital	**$3,313,171**	**$3,308,702**

EDITORIALS

VOLUME 139 NUMBER 24

December 11, 1947

Contracts and Price-Tags

NOT the least interesting aspect of the Colorado-Big Thompson Project, a ten-year progress report on which appears elsewhere in this issue, is that relating to costs and the repayment obligations of those who will be benefited by this greatest of trans-mountain diversion schemes. Originally estimated to cost $44 million, the latest figure from the Bureau of Reclamation shows a revision upward to $128 million. But the irrigation users, represented by the Northern Colorado Water Conservancy District, signed a contract for repayment ten years ago based on the old price-tag. Thus far the district has shown no enthusiasm for re-negotiating the contract. Meantime, federal officials cite as a "basic tenet" of Reclamation Law that additional monies going into a project must be paid back; to give greater force to this argument, the Appropriations Committee of the Congress threatens to withhold future funds unless the beneficiaries assume additional repayment obligation. No one could foresee, of course, that rising costs of construction, shutdowns caused by the war, and changes in design would lead to tripling the ultimate cost of the project. The decision, therefore, as to who must pay for this is one that involves a nice balancing of moral responsibilities, jurisprudence and economic relationships.

Raw Sewage Chlorination

TREATING 200 mgd. of raw sewage with chlorine in Los Angeles (p. 105) is an expensive expedient. Operating costs alone on this pollution-control program are some $1,500 a day. Thus, to free 4½ miles of beaches from quarantine for one summer's bathing season, an operating expenditure of $225,000 is being made. Bacterial content of surf samples supports conclusively the desirability of maintaining the quarantine on an additional 7-mi. stretch of beach even without consideration of visible signs of contamination. Some sanitarians take the view that chlorination of raw, unsettled sewage for disinfection purposes is impractical because the treatment does not break up the solids and hence cannot kill the bacteria contained therein. It would seem, therefore, that chlorination of raw sewage is an expensive and only partial remedy for curing pollution of beaches.

Traffic Study Needed

ACTION by the California State Toll Bridge Authority in approving two new San Francisco Bay crossings is a wise and progressive move. All agree that another crossing must be provided, but opinions differ as to where it should be located. Now the way is opened for two crossings; undoubtedly both will ultimately be built. Priority in construction is of small importance so long as both are built in the next few years. There is, however, one related problem on which little has been said officially — the traffic congestion that will be created in the several communities on either side of the bay by the construction of either or both of the new structures. The state and each of the several cities involved are doing whatever is possible by working separately, but that is not enough. The need now is for an over-all study of the Bay Region traffic problems, aimed at finding the best plan for getting vehicles to and from the crossings.

Scientific Provincialism

AT ONE OF THE SESSIONS of the Highway Research Board meeting in Washington last week, Hans F. Winterkorn, associate professor of civil engineering at Princeton, urged all highway engineers who must deal with soils to familiarize themselves with the chemistry of soils. There is no reason, he said, to be frightened away from the subject by arrays of chemical symbols that appear complicated, but actually are no more complicated than many of the mathematical equations used by engineers as a routine matter. The chemistry of soils, Prof. Winterkorn said, is not complicated and can be of great help in explaining phenomena frequently met in soil stabilization work. Prof. Winterkorn's admonition is equally applicable in many other fields of engineering. Too many engineers confine their interests to their own field of activity, fearing to venture into adjoining provinces because they are unfamiliar with the language. Learning a new language always broadens a man's outlook and generally adds to his usefulness.

How Much Construction?

STATEMENTS are beginning to appear to the effect that 1947 will be the second largest construction year in history. Don't believe them, and, above all,

don't take any satisfaction in them! As pointed out in these columns before, such statements actually say we are spending more for construction in 1947 than in any but the peak war years. The amount of construction done is something quite different. And it is inadequate and disappointing.

James W. Follin, assistant administrator, Federal Works Agency, placed the situation in proper perspective in a speech before the Structural Engineers Association of California last month, when he said that this year's $12 billion dollar volume is actually only $6.5 billion in terms of 1939 dollars. In such dollars, 1947 construction volume is about the same as 1939, and it is lower than the volume of several of the years in the 1920's. *Engineering News-Record's* Construction Volume Index tells the same story. It is 229 today; it was 211 in 1939; and it was 317 in 1929. Obviously, there is no basis for elation or even satisfaction in the physical-volume record. In some fields such as highway construction, the dollar value appears high, but the amount is far short of what is required to make up deficiencies in our highway system.

Even the dollar volume of 12 billions can be shown to be far from adequate if it is compared with the national income. During the two decades preceding 1939, an average of 10½ percent of national income was accounted for by construction. It will be less than 6 percent this year.

On any basis, then, our perspective is wrong if we regard 1947 as a good construction year. As a matter of fact, with respect to national income we should have spent 21 billion dollars instead of 12 billion to bring 1947 up to the past 20-year average. Is there the capacity to turn out that much construction? Actually, there are no statistics to prove it, and Mr. Follin, who posed the same question, properly urged the construction industry to learn more about itself in this respect in its own self interest.

In the meantime, it is obvious that there is capacity to do more than we have done in 1947. How much more might be suggested by the fact that the *ENR* Construction Volume Index in 1942 was 553, compared to 229 today, indicating a factor of 2½. Discounting the waste and inefficiency of war construction, we probably built twice as much in 1942 as in 1947.

Today, as in any ordinary year, when construction does not have the priority on materials, manpower, machines and money that it was given during the war, such high construction volume may not be possible. But the capacity is there if needed. In 1947 we haven't begun to utilize it because other industries have taken some of the materials and manpower, and because construction costs were unattractive. In 1948 the same restrictive factors may be operating, but greater volume should be sought none-the-less. A country with 15 percent more people and 200 percent more national income than in 1929 can and must build more rather than less than was built then.

The Panama Canal

EXACTLY ON SCHEDULE Congress has been handed the answer to the question it asked two years ago as to what changes are required in the Panama Canal to provide it with future security and ample capacity. Security is possible only if the locks are removed and the canal is converted to sea level at a cost of 2½ billion dollars. That is the conclusion of the extensive engineering studies of the problem, and it is the recommendation of Maj. Gen. Joseph C. Mehaffey, governor of the Canal Zone, which is concurred in by the departments of both the Army and the Navy. If security comes too high, increased capacity can be had at less cost, and in a number of alternate ways.

The security question, therefore, must be answered first, and it is to this phase of the proposal that Congress must initially address itself. The burden of proof rests with the armed services, for neither the engineer nor the layman can advise Congress on the probable size of future battleships, on the exact amount of damage that one atomic bomb would cause, on the means available to protect a lock canal, on the procedures and time involved in rendering the canal area habitable after an atomic bomb had sprayed radioactive water over the countryside or saturated earth slides with radioactive particles. To make these facts known will necessitate a change in military thinking on what is secret, but approval of the huge cost involved in a sea-level canal at Panama would seem to require that all controlling data be made available. Engineers and construction men will await the hearings on the Panama Canal proposal with much interest.

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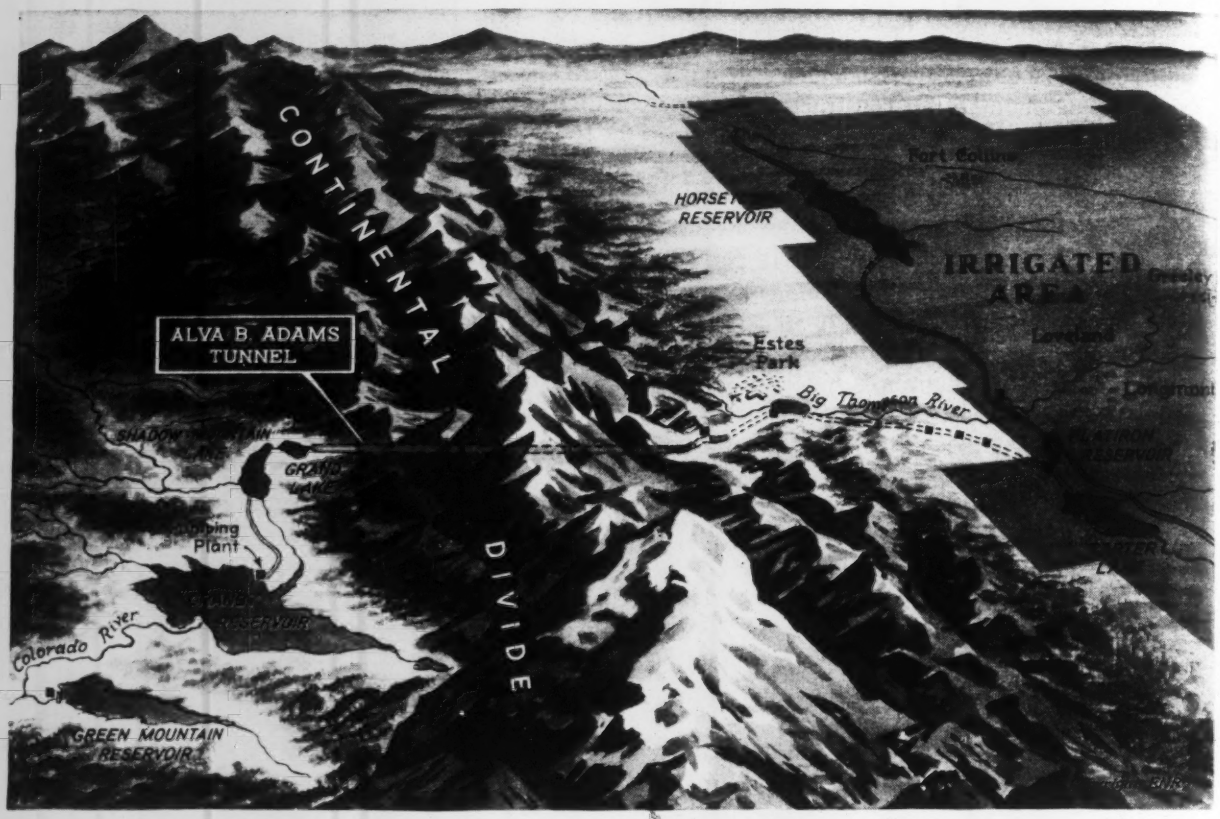

Elements of the Colorado Trans-Mountain Diversion

A 13-mi.-tunnel through the Continental Divide is the principal feature of the Colorado-Big Thompson project, which will transfer water from The Pacific slope of the Rocky Mountains to the Atlantic drainage basin on the eastern side. Supplementary works include storage and pumping facilities on the western slope, as well as terminal reservoirs, conduits, canals and power plants on the east side. Designed by the Bureau of Reclamation, the plan of operation and details of the project are as follows:

Excess waters of the Colorado River and its tributaries will be stored at Granby reservoir. The main dam, an earthfill, is 295 ft. high and has a crest length of 885 ft.; four small earthfills are being placed to close gaps between surrounding mountains. Collection works include Willow Creek and Meadow Creek-Strawberry Creek dams.

A pumping plant will lift water 186 ft. to Shadow Mountain Lake, which is an enlargement of Grand Lake created by building Shadow Mountain Dam. In addition to capturing water from the North Fork of the Colorado River, Shadow Mountain Lake serves primarily to add to the holding capacity at the Adams tunnel portal and to maintain the water surface of Grand Lake at a constant level.

Water diverted from the Colorado River is compensated by storage of floodwaters on the Blue River, a tributary, in the reservoir created by Green Mountain Dam. This 155,000 acre-ft. reservoir serves western slope water needs. A power plant of 21,600 kw. capacity is in operation.

From Shadow Mountain Lake water will flow through Grand Lake to the eastern slope of the Rockies through the 13.07-mi. Alva B. Adams Tunnel, longest tunnel ever driven from only two portals. Inside diameter of the concrete-lined tunnel is 9.75 ft.; flow capacity is 550 sec.-ft.

This diversion will permit eventually an annual average production of more than 750,000,000 kwh. of power in passing through seven plants. Two are under construction at present. One of these, the Marys Lake plant, is near the eastern tunnel portal where advantage is taken of a 210-ft. drop. From lake storage, the water will fall 482 ft. to go through turbines at the Estes Park power plant. The discharges will enter a reservoir created by Olympus dam on which construction has started. This reservoir will maintain constant flow in the Big Thompson River.

The diversion will bring 310,000 acre-ft. of supplemental water in an average year to 615,000 acres of already irrigated land. Foothills storage reservoirs included in the project are Horsetooth, Carter Lake and Flatiron. Construction of Horsetooth reservoir is under way; here four separate rock and earth embankment dams will convert a natural basin into a storage reservoir of 146,000 acre-ft.

Carter Lake, to the south of Horsetooth, also will be created by closing gaps in ridges surrounding the area with three separate rock and earth embankment dams. Storage capacity will be 110,000 acre-ft. Flatiron reservoir, with 23,000 acre-ft. capacity, will be used for regulation.

Distribution system facilities will include these supply canals: Carter Lake, Horsetooth, the St. Vrain, Big Thompson, Poudre, Poudre Valley, and North Poudre. Pumping plants will lift water from one reservoir to another as needed, and also supply feeder canals.

Not yet under construction are the system of tunnels, canals, penstocks and power plants that will lower the water from Estes Park to the foothills storage reservoirs. A full supply of irrigation water and complete power development is expected by 1952.

THE COLORADO—BIG THOMPSON JOB

A progress report on one of the world's great irrigation projects, which was initiated a decade ago and will require five more years for completion.

Edward J. Cleary
Executive Editor, Engineering News-Record

ON JUNE 23, Gov. William Lee Knous of Colorado stood on the shores of Grand Lake, on the western slope of the Continental Divide. At precisely 11:15 a.m. he pushed a button that opened the intake gate to a water tunnel. Jumping into his car, he was sped for 50 miles across the Trail Ridge road through snow-lined Milner Pass, arriving at Estes Park in sufficient time to take his place among the watchers at the east portal of that tunnel.

When water gushed forth exactly three hours after the governor opened the gates, it signified that the world's major transmountain diversion had become a reality. Water from the melting snows on the western slope of the Rockies that previously had no alternative but to flow into the Pacific now could be put to use on the eastern slope of the Continental Divide where additional water is badly needed.

The ceremonies last June that marked this historic moment on the Colorado-Big Thompson Project, however, must be considered only as an interim affair—something akin to the rite of flying a flag from the topmost point of a partially completed building. Lots more work remains to be done on this $128 million project of the Bureau of Reclamation. Started in 1938, its execution was curtailed during the war years, and only now is the work gathering momentum for ultimate completion in 1952.

Plan of the project

Although the construction operations are costly, and have called for considerable skill, the scheme for diversion is quite simple. The principal elements are: (1) Western-slope storage facilities to capture excess waters of the Colorado River; (2) a 13-mile tunnel to bring these waters eastward under the Continental Divide; and (3) terminal storage reservoirs on the eastern-slope foothills, along with distribution canals to provide supplemental water on land already under irrigation.

Since the water will drop some 2,900 ft. from the outlet of the Continental Divide tunnel into the irrigable valley land 22 miles away, power generation facilities will be installed at several points. Salable power production is expected to provide 750,000,000 kwh. annually, the greater part being sold directly to towns and cooperatives in northeastern Colorado.

Details of the structure to accomplish this are outlined in the accompanying tabulation.

The purpose of the project is to furnish additional water to 615,000 acres of land already under cultivation in northeastern Colorado, which has suffered in the past from periodic water shortages. Even under the best conditions there has seldom been enough water in the late growing season to irrigate these lands in the valleys of the Big and Little Thompson, Cache la Poudre, St. Vrain, Boulder and South Platte rivers.

Long ago it became apparent that the only adequate solution to the problem would be to bring water from the western slope of the mountains. But it was not until 1935 that the late Senator Alva B. Adams (for whom the tunnel under the Continental Divide is now named) was instrumental in securing $150,000 from National Industrial Recovery Act funds for surveys and cost estimates. These studies for diversion were made by the Bureau of Reclamation, and Congress provided funds for starting the work in 1938.

Project costs have trebled

Originally, the cost of the project was estimated to be about $44 million. But a revised estimate last year put the completion cost about three times greater, or about $128 million. Spokesmen for the Bureau explain this by pointing to "an unparalleled rise in prices and labor rates incident to the impact of war and recovery" as well as to revisions of the original plan to provide increased power production and greater efficiency in the regulation and use of the water supply. Details of how the increased costs have affected various elements of the project are reviewed further on.

While admitting to the validity of the Bureau's assertion, other informed persons feel, nevertheless, that the original estimates were too low and not entirely realistic.

All of this is leading to complications concerning the repayment features, concerning which the Bureau is now seeking to determine how much the Northern Colorado Water Conservancy District can afford to pay without jeopardizing its financial status. The district, which was created by the state as the agent for all those who will be benefited by the water, signed a contract in July 1938 calling for payment of not more than $25 million over a 40-yr. period. This was done in accordance with normal procedures under the Reclamation Law wherein the beneficiaries are pledged to pay back that part of the cost of the project, less interest, allocated to irrigation needs.

But this repayment contract was

Fig. 1. Green Mountain Dam, on the western slope, creates a reservoir on the Blue River. These stored waters will compensate irrigation users for that flow of the Colorado River that is diverted into the eastern-slope watershed.

based on early estimates of costs, which will be trebled before the project is completed. Accordingly, the Bureau seeks to negotiate a new contract that will give recognition to these higher costs and provide for a larger repayment. So far, little progress in this direction can be reported.

Colorado spokesmen have not said much. But U. S. Reclamation Commissioner Michael W. Straus made plain the official Washington viewpoint, when he said at the tunnel ceremonies last June:

"The additional money, over and beyond the prewar costs, that Uncle Sam is putting into this project to complete it now, must be paid back. That always has been a basic tenet of the Reclamation Law. But there is another and quite simple and compelling reason. All of this money came from Congress through the Appropriations Committee—an institution before which the chosen representatives of this conservancy district, this state, and myself spend much time and with which we are more familiar than perhaps we would like. Also, all the millions that still will be needed to complete the Colorado-Big Thompson Project can come only through that same committee or its successors. That committee made the expenditure and repayment principle crystal clear and simple in their report which the Congress approved less than a month ago. They said, among other things, in that report:

"The committee has requested the Commissioner of Reclamation to have increased construction costs for irrigation facilities reflected in new or amendatory repayment contracts for projects under construction or where work has not started. . . . Future appropriations for projects in Colorado and elsewhere will depend upon the willingness of prospective beneficiaries to assume additional repayment obligations."

Commissioner Straus emphasized that the same factors responsible for increase of project costs have also increased the estimated values of agricultural products resulting from the use of project water. Prewar average value of crops was cited as $7,000,000. Today, these same crops are said to produce a revenue of close to $20,000,000. Thus, it would appear, the trebled costs of the project are compensated by a trebled income from crops.

At this point a word is in order regarding the manner by which the conservancy district will finance the repayment. Three-quarters of the district's funds will come from charges levied on irrigators who will pay $1.50 per acre-foot of water. The balance is obtained from an ad valorem tax of one mill on all taxable property (including that in towns and cities) lying within the district.

This ad valorem tax established for the first time the principle that all those within an irrigated area share in the benefits and thus should share in the costs. It has since been employed on several other projects.

Major construction underway

Work now under way on the Colorado-Big Thompson Project, is centered in three locations—in the Estes Park area, at Granby reservoir and at the Horsetooth terminal reservoir.

At Estes Park, near which the Adams Tunnel has its eastern outlet, contracts totalling some $16 million have been awarded. Lining of the Adams Tunnel, which was holed through in June, 1944, was completed in February, 1946.

In commenting on the cost of the tunnel, Bureau officials point out that the total is $12,400,000, compared with an original estimate of about $7,300,000. Of the increase, about two-thirds is represented by the increasing cost for labor and material and the balance by adjustments that had to be made with the contractors from time to time because of work stoppages enforced by other governmental agencies during the war.

From the outlet of the Adams Tunnel a temporary pipeline has been

installed by The Big Thompson Pipe Line and Irrigation Co. to permit partial delivery of water to the Big Thompson River until such time as the permanent diversion works are ready for use.

These permanent diversion works, in the order of use as the water flows down the eastern slopes, are:

East Portal Reservoir—Formed by a small dam some 700 ft. from the outlet of the Adams Tunnel, this reservoir provides a location for an overflow emergency spillway into the Wind River as well as the diversion entry into

Aspen Creek Siphon—A 1.32 mile reinforced concrete conduit, with an inside diameter of 10.75 ft. and an average thickness of 13 in.; capacity is 550 cfs. This is being built in open cut, the backfill to provide a cover of 5 ft. The siphon leads into

Rams Horn Tunnel—A concrete-lined, horseshoe-shaped structure, 10 ft. in diameter, this tunnel is 1.31 mi. in length with a difference in elevation of only 7.5 ft. between portals. Work is virtually completed. Water leaving the tunnel will fall some 212 ft. through

Marys Lake Penstock—A 96-in. pipe line, 521 ft. long, made of plate steel varying in thickness from $\frac{3}{8}$ to $\frac{7}{16}$ in. Assembly has not yet started on this pipe line, which leads into the

Marys Lake Power Plant—A 62 x 64 ft. reinforced concrete building, now under construction, it will house a 9,000 kva. vertical-shaft generator driven by an 11,300 hp. turbine. Turbine discharge will flow into

Marys Lake Reservoir—A natural lake, whose capacity will be increased by the construction of two dikes. The latter will have a crest height elevation of 8,050, some 25 ft. above the natural lake level. Maximum operating level will be El. 8,035, the lake serving to regulate water in the generation of power at the Estes plant. Before reaching the latter, however, water must pass through

Prospect Mountain Conduit—This is a reinforced concrete tube with a diameter of 12.5 ft., and a length of 0.6 mi. It will be built in open cut and backfilled to provide a minimum cover of 5 ft. Carrying a flow of 1,300 cfs. it will discharge, under pressure, into

Prospect Mountain Tunnel—Likewise 12.5 ft. in diameter, this 1.07-mi. tunnel is nearing completion with lining operations now under way. One of the features of this tunnel is the inclusion of a vertical surge chamber near its outlet. Excavated from the hillside surface to an enlarged section of the tunnel bore, the chamber is 50 ft. in diameter and about 100 ft. in height, it is now being lined with reinforced concrete. The tunnel will discharge into the

Estes Penstocks—These are three steel-plate tubes, each with a diameter of 78 in. To be constructed above ground surface for the most part of their 0.75-mi. length, they will be placed underground where they cross a corner of the town of Estes Park and there lead into the

Estes Power Plant—This is a principal power development unit on the eastern slope, to include three 16,667 kva. vertical-shaft generators, driven by 21,000 hp. turbines. Average operating head will be 534 ft. The unit will be housed in a reinforced concrete building, 98x145 ft., foundation excavation for which has been completed. Serving as the afterbay for this plant is a reservoir formed by

Olympus Dam—Now under construction at a point 1.5 mi. below the town of Estes Park, this structure will provide means for re-regulation of flow to a uniform rate for the generation of power at future plants lower down. The earthfill dam, with a concrete gravity overflow spillway section, will be 56 ft. high, and 1,300 ft. long. Until the downstream power plants are installed, the reservoir can be discharged into the Big Thompson River, and thus it will also serve as a flow regulator for river discharges.

Operation of power plants

Operation of the power plants in the Estes Park area are described as follows by C. H. Howell, former USBR project engineer, recently retired, and Frank Matekja, construction engineer:

"The three 16,667 kva. units at the Estes plant will supply power to the government interconnected transmis-

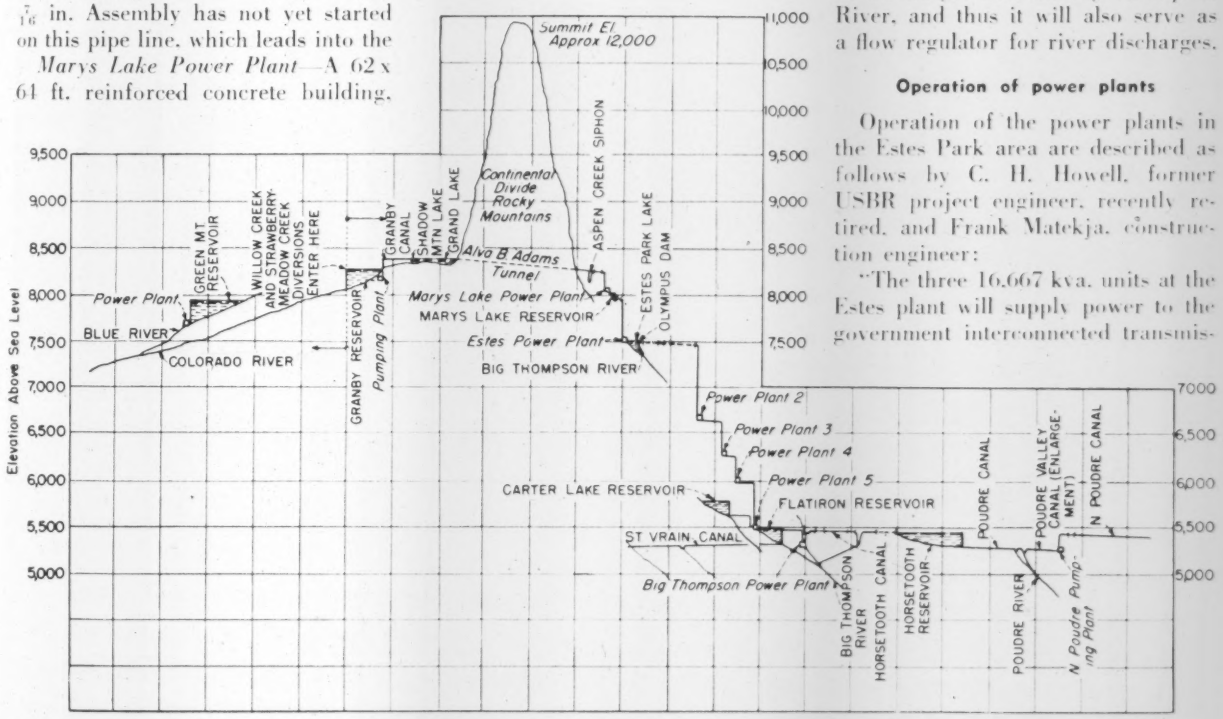

Fig. 2. Profile and diagrammatic layout of the Colorado-Big Thompson project features. Granby reservoir serves as the point where diversion to the east begins.

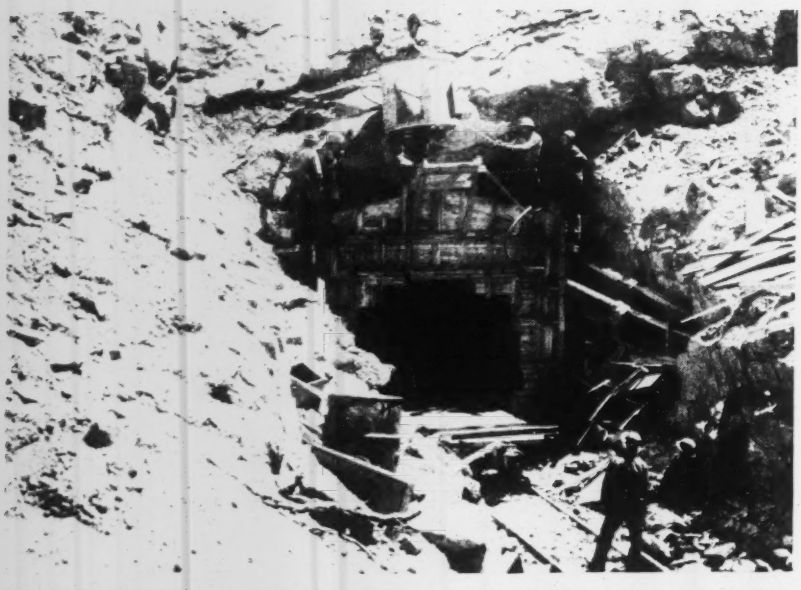

Fig. 3. Final concreting operations on the west portal of Rams Horn tunnel. This conduit, 1.3 miles in length, leads water to the Marys Lake penstock where a drop of 212 ft. will be utilized to provide power.

DAM	HEIGHT FT	CREST LENGTH FT	IMPERVIOUS FILL CU. YDS	PERVIOUS FILL CU YDS
Horsetooth	125	1600	1,450,000	405,000
Soldier Canyon	205	1400	2,450,000	822,000
Dixon Canyon	220	1200	2,000,000	1,000,000
Spring Canyon	205	1110	1,425,000	785,000

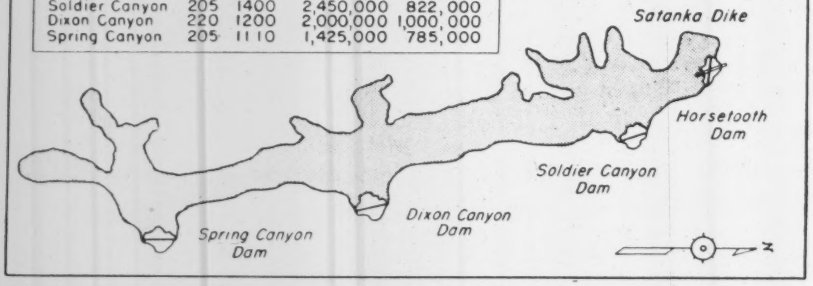

Fig. 4. Largest terminal storage on the eastern slope is provided by Horsetooth reservoir. It will be formed by building four dams and a dike that act as closures to a huge natural basin. Details of the dams are shown in the tabulation.

sion system in Northern Colorado, Wyoming and Western Nebraska. When the power output of these units is not required, they will be motored on the system to provide regulation and for spinning stand-by generating capacities. At such time, when the units are motoring, the butterfly valves in the penstocks will remain open to permit the leakage water past the turbine wicket gate to cool and lubricate the runner seals."

"The 9,000 kva. units at the Marys Lake power plant will also supply power to the government interconnected system and will be remotely controlled from the Estes plant, a distance of three miles."

"A power transmission line, some 39 miles in length, will be constructed from the Estes plant to the Granby pumping plant, crossing the Continental Divide at Buchanan Pass. The power thus furnished in addition to that generated at the Green Mountain plant will supply power for the pumps at Granby reservoir. Water from that reservoir thus will flow into the Granby pump canal, then into Shadow Mountain Lake, Grand Lake, and finally into the Adams Tunnel."

Why costs have increased

As with other parts of the Colorado-Big Thompson Project, costs have increased on the Estes aqueduct and power system over the original estimates made ten years ago. Reasons for this are outlined by Bureau spokesmen as follows:

"The original plan contemplated one power plant to use the total drop in this section and no reservoir below the power plant, with the results that the power produced by the plant would be very uniform. Since power demands are variable, a large part of the output thus would have had to be marketed at low rates as dump power. A restudy of the power market showed a desirability of fluctuating power output to parallel power demands.

"The desired result was obtained by introducing Marys Lake and Estes Park Lake, which enabled the Estes power plant to produce "peaking" power, and yet not disturb the uniformity of flow from the Adams Tunnel and the power and irrigation system below Estes Park. With the Marys Lake plant added, the full head is utilized and the power output of the plant is made wholly saleable at firm power rate, instead of a considerable part of the output otherwise available only at a dump power rate."

The original estimate and the presently estimated cost upon completion compare as follows:

Item	*1937 Estimate*	*1946 Estimate*
Estes Aqueduct	$1,101,000	$7,029,368
Marys Lake Power Plant	(not in plan)	$1,096,539
Estes Power Plant	$1,778,000	$4,435,579
Estes Park Lake & Olympus Dam	(not in plan)	$1,914,000
Total	$2,869,000	$14,475,486

Of the increase of $11,600,000 cost, about $4,000,000 is represented by increases in unit costs for labor and material for work contemplated in the 1937 plan. The balance is represented by the cost of nearly doubling the power installation, and of adding the two reservoirs in order to secure peaking power capacity.

Western slope construction

As detailed in the tabulation of the diversion plan and key structures (on the second page of this article) western-slope storage facilities include Grand Lake, Shadow Mountain Lake, and Granby reservoir. The first two, which are interconnected to form what is virtually a single storage basin, are at an elevation to permit gravity flow into the tunnel. Water collected in Granby reservoir, however, must be pumped to reach a canal that will discharge by gravity into Shadow Mountain Lake.

Now under construction is this canal and the pumping plant, as well as the dam and four dikes that will form Granby reservoir. These are the details:

Granby Reservoir—Formed by a dam and four earthfill dikes across the Colorado River and adjacent saddles, this basin will have an active storage capacity of about 460,000 acre ft. Forming the second largest body of water in Colorado it is exceeded in size only by the John Martin reservoir where capacity is 655,000 acre ft. It was first advertised for construction in 1941 but due to war restrictions only the diversion tunnel was completed. Construction of the Granby Dam and Dike No. 3 was started in August 1946 and is scheduled for completion in February 1950. Construction of Dikes No. 1, 2, and 4 under another contract was started in December 1946 and is scheduled for completion in January 1949. The 1946 estimated cost of this reservoir is $10,100,000.

Granby Pumping Plant—In a reinforced concrete building located on the north shore of Granby reservoir there will be housed the pumps, motors, and accessory equipment to pump water collected and stored in Granby reservoir into Shadow Mountain Lake. The three pumps, each capable of discharging 200 cfs. under a maximum head of 186 ft. will be driven by three 6,000 hp. motors. Construction of the building, both its intake and discharge lines, was started in April 1947 and is scheduled for completion in November 1949. The 1946 cost estimate for this completed plant is $6,474,000.

Granby Pump Canal—This forms the connecting link between the discharge line of the Granby pumping plant and Shadow Mountain Lake. It has a designed capacity of 1,100 cfs. and is 2.1 mi. long. Work was started in May 1947 and is scheduled for completion in June 1949. The 1946 estimated cost is $410,000.

Shadow Mountain Lake—Work is completed on this storage facility, which is an extension of Grand Lake from which the Adams Tunnel diverts. Enlargement of Grand Lake by the construction of Shadow Mountain Lake allows wide latitude for project operations without disturbing the water surface elevation of Grand Lake.

Fig. 5. One of the closures in the "hog-back" forming Horsetooth reservoir is Spring Canyon Dam. This earthfill will be 205 ft. high and have a crest length of 1,110 ft.

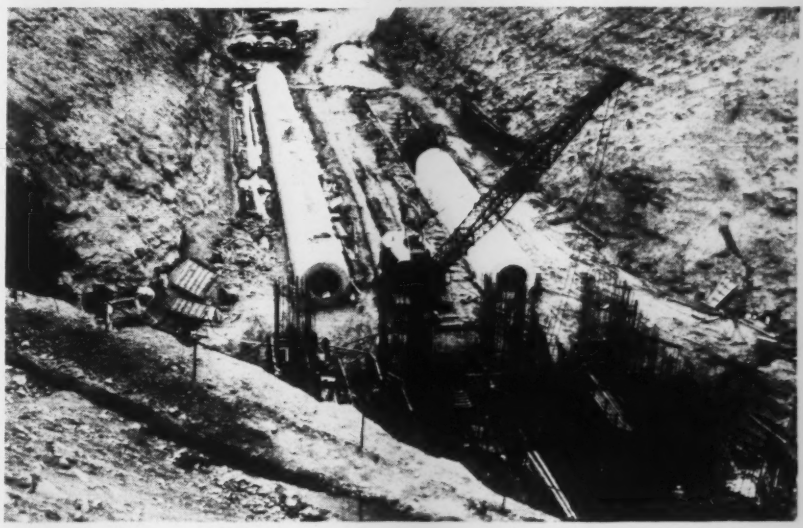

Fig. 6. Intake pipes and pumping plant structure at Granby reservoir where water will be lifted 186 ft. for discharge into Shadow Mountain Lake.

The manner in which costs have increased on these elements of the project are analyzed in this fashion by the Bureau:

The 1937 plan contemplated a reservoir with an active capacity of 462,000 acre-feet, a pumping plant with a capacity of 900 cfs. to lift water to the level of Shadow Mountain Lake and a conduit from the pumping plant to Shadow Mountain Lake with the following costs:

Reservoir	$2,813,703.00
Pumping Plant	$1,250,000.00
Pump Canal	$ 417,553.00
Total (1937 estimates)	$4,481,256.00

Granby Dam was advertised in the fall of 1941, and on the basis of the low bid received, the total cost of the dam and the reservoir was then $5,653,900, or about twice the original estimate. This 100 percent increase in cost between 1937 and 1941 reflected in part the construction unit cost increases, but was in large measure a manifestation of the insecurity felt by the contractors in making long-term commitments because of the imminence of war.

In the year following, a very careful restudy was made of the combined plan for the reservoir, pumping plant and canal, with conclusions reached that it would be desirable to hold down construction costs by raising the water surface eight feet, which permitted raising the pumping plant and reducing the head without a decrease in active storage capacity.

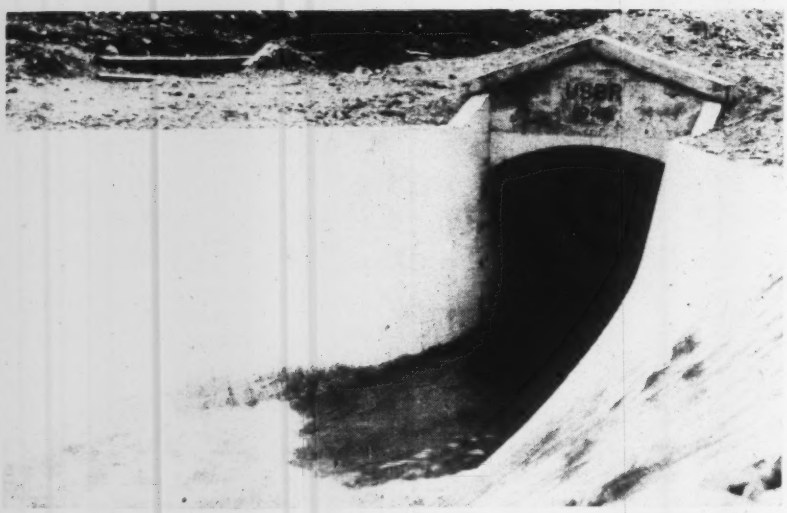

Fig. 7. First water from the western slope discharging from the Alva B. Adams tunnel during the dedication ceremony on June 23, 1947.

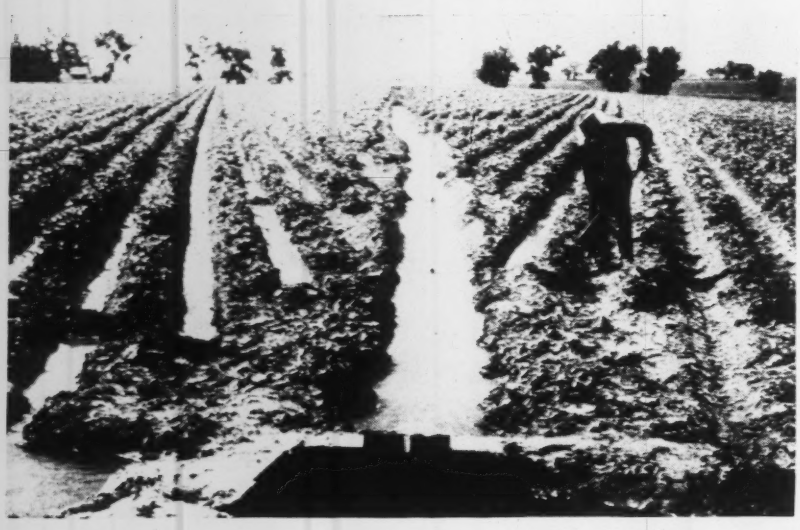

Fig. 8. West slope water will furnish supplementary irrigation for farms on the eastern side of the Continental Divide, such as the one pictured above.

It was also found desirable to relocate the pumping plant and canal to avoid tunnel construction, and to increase the capacity of these features to 1,100 cfs. with the addition of an extra pump. By so doing it was possible to avoid the use of firm power for the operation of the pumping plant, and thus increase the income from the sale of such power.

The completed cost of the reservoir, pumping plant and canal, which are now under construction, is estimated at $16,934,000. Roughly half of this increase represents increased contractors costs, due in part to increased labor rates, and in part to a full appreciation of the difficulties of construction in this locality, with its short working season.

The balance of the increase is said to represent rapidly increasing land values, the greater care found necessary in the selection of construction materials, to increased excavation in the foundations, and to changes that will reduce operating costs with offsetting increases in power revenues.

Construction of the Shadow Mountain dam and reservoir was initiated during the war at the request of water users to hasten diversion for east slope lands under the war load program. The high cost of wartime construction combined with the inefficiency of manpower and equipment then available increased the cost of this facility from $483,928 to $1,050,000, in spite of a design change from a concrete to earthfill dam in an effort to lower costs.

Dams for Horsetooth reservoir

Turning now to the terminal reservoirs in the eastern foothills, of which there are three—Horsetooth, Carter Lake and Flatiron—construction is active at present only on the Horsetooth job. The latter involves the building of four earthfill dams, which will form closures to a natural basin that provides water storage capacity of 147,322 acre-ft.

This basin was formed as a result of geological changes that caused an uptilting of sedimentary rocks lying at the foot of the Rocky Mountains. Consequent erosion of the softer rocks created a valley between the mountain and the "hogback" of uptilted hard rock that lies parallel to it. At three places along the hogback there are V-notch, steep-walled canyons. By building dams at these canyons, as well as one at the northern gap of the valley, it becomes possible to totally inclose this valley. Fortuitously, the southern end of the valley slopes upward and is high enough to form a natural embankment.

Location and principal data related to these dams are shown in Fig. 4.

The reservoir thus formed is some 6½ mi. in length and has a variable width of ¼ to ¾ mi. All the dams have a crest elevation of 5,440 ft., the high-water level of the reservoir being ten feet below this. No spillways are provided on any of the dams. But a small dike closing a saddle opening northwest of the Horsetooth dam will be purposely kept four feet lower than the dam and thus act as a "fuse-plug" or emergency spillway. This structure, known as Satanka dike, is about 285 ft. long and has a maximum height of 15 ft.

Outlets for the reservoir are provided at two locations—a conduit through Horsetooth Dam and a tunnel through the rock abutment of Soldier Canyon Dam. The latter, of 5 ft. dia., upstream from the axis of the dam, and of a 6 ft. horseshoe section on the downstream side, is an auxiliary outlet. It was selected in preference to a long side-hill canal for supplying water to the area directly east of the reservoir. Releases up to 60

cfs. can be made through this tunnel.

The outlet under the center of Horsetooth dam consists of a single concrete tube 8.5 ft. dia. with walls 2 ft. thick, followed by twin horseshoe conduits of 10 ft. diameter. Inside each of the latter there will be installed a 6 ft. dia. steel penstock. The penstocks will discharge into the Poudre Supply Canal, principal feeder to the northern area of the irrigation district. Outflow through this structure will be limited to 1,500 cfs. which is the capacity of the canal.

Horsetooth and Soldier Canyon dams, as well as Satanka dike in the northerly section of the reservoir are being built by a combination of three firms (see tabulation of contracts) at a total cost of $5,111,877. Fill for the impervious sections of these two dams is now being placed, the completion of which is scheduled for May 1949.

Dixon Canyon and Spring Canyon dams also are under construction, with completion expected by May 1949. This contract totals $4,319,427.

Flatiron reservoir, which will be located at the outlet of the Estes-Foothills aqueduct and power system, will provide "peaking" capacity for firm power to be produced by the Flatiron Mountain power plant. It will also be the distribution feature for irrigation water to be diverted to the north through the Horsetooth Feeder Canal or south through the St. Vrain Supply Canal. This reservoir will have an active capacity of about 5,000 acre ft. and will be formed by one earthfill dam similar to those constructed to form the Horsetooth reservoir. The 1946 estimated cost is $2,760,000.

Carter Lake reservoir, the southern element of the eastern-slope storage system, is to be located immediately south of Flatiron reservoir. It will be formed by three earthfill dams across notches in the foothills (similar to those at Horsetooth reservoir), and provide an active capacity of 110,000 acre ft. Carter Lake will be filled and drained through a penstock and pressure tunnel connected with the Flatiron Mountain power plant and the Estes-Foothill aqueduct and power system. The 1946 estimated cost is $8,200,000.

Revised estimates on the Horsetooth reservoir storage system, reflecting changes in plan as well as higher costs for labor and materials, show an increase of more than $12 million above the original figure of $8 million. Revised costs on the Carter-Flatiron lake projects indicate an increase of close to $6 million above the 1937 estimate of $2.5-million.

This concludes the story of the Colorado-Big Thompson project as it stands today. Nine years have elapsed since construction was initiated, and at least another five years must pass before the major elements of the project are in full operation. The vicissitudes of war have retarded progress and spiraling prices have increased costs. But a vast amount of work has been done on one of the world's great irrigation schemes.

And the dream of bringing western slope water to the eastern side of the Continental Divide—a vision that inspired pioneers in Colorado more than half a century ago—has now become a reality.

Engineering direction

The Colorado-Big Thompson Project is being built by the Bureau of Reclamation, of which Walker R. Young is chief engineer. Project operations are under the jurisdiction of the Region 7 office in Denver, the director of which is Avery A. Batson. E. S. Huntington is acting district manager.

George Highley is construction engineer on Western Slope operations, Frank K. Matejka in the Estes Park Area, and R. B. Ward in the Foothills North Area.

MAJOR CONSTRUCTION CONTRACTS ON THE COLORADO-BIG THOMPSON PROJECT

Contract	Contractor	Amount	Date Started
Green Mountain Dam and power plant.	Warner Construction Co., Chicago	$4,226,206	Dec. 1938
Shadow Mountain Dam	J. F. Shea Co., Los Angeles	440,740	Jan. 1944
Continental Divide Tunnel (excavation, Sta. 618 to 698)	S. S. Magoffin Co., Inc., Englewood, Colo.	471,123	May 1940
Continental Divide Tunnel (excavation, Sta. 6 to 72)	Platt-Rogers, Inc., Pueblo, Colorado	389,370	Aug. 1940
Continental Divide Tunnel (excavation, Sta. 618 to 548 and concrete invert, Sta. 698 to 552)	S. S. Magoffin Co., Inc., Englewood, Colo.	748,711	April 1941
Continental Divide Tunnel (excavation, Sta. 72 to 152, and concrete invert, Sta. 6 to 148)	Stiers Bros. Construction Co., St. Louis, Missouri	832,906	Aug. 1941
Continental Divide Tunnel (excavation, Sta. 350 to 284)	S. S. Magoffin, Co. Inc. Englewood, Colo.	771,145	Sept. 1943
Excavation and concrete lining for Ramshorn and Prospect Mountain tunnels, Power Canal No. 1	Lowdermilk Bros., Denver, Colo.	1,864,822	April 1946
Excavation and concrete lining for diversion and outlet tunnel, Granby Dam	Platt-Rogers, Inc., Pueblo Colo.	283,180	Dec. 1941
Granby Dikes 1, 2, and 4	John R. Austin Co., Grand Lake, Colo.	418,080	Oct. 1942; resumed Dec. 1946
Granby Dam and Dike 3	Granby Constructors, Colorado Springs, Colo.	5,988,969	Aug. 1946
Granby pumping plant	Granby Constructors, Colorado Springs, Colo.	$1,139,908	April 1947
Granby Pump Canal	Vinnell Co., Inc., Alhambra, Calif.	501,358	May 1947
Horsetooth Reservoir: Construction of Horsetooth and Soldier Canyon dams, Satanka Dike	Grafe-Callahan Construction Co., Gunther & Shirley Co., W. K. McIlvar, Los Angeles, Calif.	5,111,877	Aug. 1946
Horsetooth Reservoir: Construction of Dixon Canyon and Spring Canyon dams	Hinman Bros. Construction Co. and Rhoades Bros. & Shofner, Los Angeles, Calif.	4,319,427	Sept. 1946
Excavation and concrete lining for Tunnels 2, 3, 4, and 5, Horsetooth Feeder Canal.	Tunnels Constructors, Denver, Colorado.	1,838,352	Aug. 1947
Construction of earthwork and structures for Estes and Marys Lake power plants and switchyards, penstock gate structures and penstocks and Marys Lake spillway	Morrison-Knudsen Co., Inc., and Peter Kiewit Sons' Co., Omaha, Nebr.	216,708	May 1947
Construction of earthwork and structures for Aspen Creek siphon, Prospect Mountain conduit, and Marys Lake Reservoir, dikes and road relocation	Horner and Switzer, Denver, Colo.	1,611,953	Aug. 1947
Construction of Olympus Dam and Highway No. 66 and Fish Creek road.	David G. Gordon and Bressi & Bevanda Constructors, Inc., Denver, Colo.	1,375,479	Aug. 1947

A Building Official Looks at Codes

Harry A. Cobden
Chief Building Inspector
Berkeley, Calif.

***Editor's Note**—This abstract of a paper delivered at the convention of the Structural Engineers' Association of California held recently at Yosemite National Park points out many of the evils that exist in building codes today. It is published here with the hope that engineers, building officials and others concerned with codes will benefit from the opinions of one building official who has given considerable thought to the subject.*

BUILDING CODES are, today, the subject of much discussion and criticism. As a building official I want to point out what, in my opinion, are the requirements of a good code and also what are some of the flaws in existing codes.

Three items in the content and application of codes are of primary importance. These are: (1) All building laws should set up minimum requirements only. (2) Every code should have within itself provisions for substituting materials and methods. (3) The sole aim of regulation should be the assurance of safety.

This country is full of antiquated building laws. There are codes in use today that were written so long ago that the mind and memory of man runneth not to the contrary. Thus, the public is forced to shoulder an added and useless burden caused by those antiquated and costly requirements. Imagine the costly and doubtful results obtained by enforcing a reinforced concrete code based on ideas of 1900 or a steel code specifying the stresses of 1910.

To be at all effective, a code must be so designed that it can be kept abreast of the times through revision and improvement when progress demands it. The code should include basic requirements only and should allow the designer to have as much latitude as possible within safe limits.

Codes used for featherbedding

Plumbing and electrical codes have their place in this discussion and, in my opinion, it is downright criminal the way the plumbing associations, unions, and industry have featherbedded themselves into certain codes. In Alameda County, Calif., there are exactly 20 different plumbing codes. Now, even the uninformed know that water runs the same in any part of that country. Until the Supreme Court decided otherwise, the plumbers had built a "Chinese wall" around every city in the state so only a limited number could get a license to do plumbing work. In many cases, codes have been framed to make jobs for one group of building craftsmen at the expense of some other group and to increase the use of certain types of material at the expense of manufacturers of other types that may be equally good or even superior.

Today's overwhelming need for an increased volume of housing at lower cost has accentuated the importance of developing new materials and construction techniques. Unless the acceptance and use of new products and systems of construction are accelerated, we will not obtain the full benefit of all the new developments in housing.

Now one might wonder what has all this got to do with building officials. The answer is very simple. If a building is going to cost as much as it has in the past, housing can well become a luxury that only a very few can afford, and the building official can become extinct. So the very existence of building officials is concerned.

Building costs too much

The principal problem resolves itself down to a fundamental economic problem, i.e., building costs too much. We are still using the same methods of construction that were used over 2,000 years ago. Housing is the most expensive thing we buy today and it has always been so. If we paid in the same proportion for any other commodity or consumer goods today that we pay for houses, we would indeed be hard put as a nation. Due to the war and other causes, we are in need of many millions of dwelling units.

The building industry, the government, capital, labor and, above all, the technical groups, must combine their resources to start production — not tomorrow, but now.

The war has placed the building industry at a crossroads. It can follow the old road with its uneconomical hit-or-miss methods, house only a portion of our people, or it can chart a new course as followed by some industries and plan to house everyone properly at prices that are equitable.

Restrictive codes must go

Every person, regardless of his station in life, is entitled to a shelter, and I believe that the building industry should and must be free of handcuffs, be they economic or government restrictions. However, it must be recognized that all building today is vested with a public interest, and an industry that cannot give the public a safe functional shelter, or a building official that will foster archaic codes, is not an industry or an official that the country wants or means to endure. All too many officials, engineers and architects are loathe to change anything. This reaction results in a bottleneck that is reflected in the end product.

Building officials are prone to treat codes with far more veneration than is deserved. Codes are considered like the Ark of the Covenant, too sacred to be touched, and the authors of codes are felt to have far more wisdom than they ever possessed. You can readily see that a code loses its effectiveness in a very short time if this theory is followed. To compel one to use a code of 1900 or even 1940 today is like trying to fit a grown man into a coat that he wore as a boy.

The day will come when basic codes will be on a national basis. At that time building officials will be in a much better position to cooperate with industry, the architect, the engineer, and the scientist to go forward to building a safe, happy, abundant America.

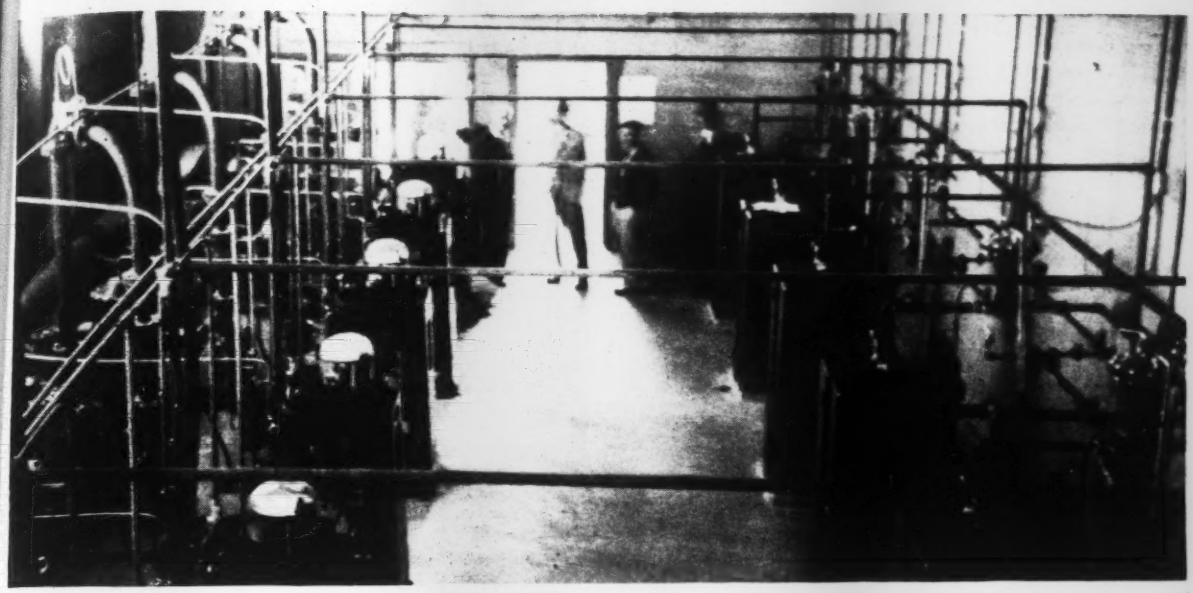

Fig. 1. Part of the installation at Hyperion sewage outfall, which handled as much as 21 tons of chlorine daily.

Chlorination Curbs Beach Pollution

***Contents in Brief**—Raw sewage in quantities averaging almost 200 mgd. was chlorinated at Los Angeles' Hyperion screening plant during the 1947 ocean-bathing season to reduce contamination of the water. Seven chlorinators, each of 6,000 lb. capacity were required to dose this large flow. As a result it was possible to lift a health quarantine on a 4½ mi. stretch of beach. Installation and operating results are discussed.*

CHLORINATION of the entire flow of Los Angeles sewage (averaging 198 mgd.) last summer permitted the lifting of a quarantine from 4.52 miles of the 11.52 miles of beaches that had previously been closed to public use because of pollution. To accomplish this an average of 18 tons of chlorine a day was applied by seven chlorinators each of 6,000-lb.-a-day capacity.

This unusual chlorination program resulted from a court order obtained by the California department of public health requiring disinfection of the city's sewage by chlorination or other effective means from June 1 to Oct. 31 each year until treatment and outfall facilities, now in the initial construction stage, are completed and beach pollution is eliminated (*ENR* May 29, 1947, vol. p. 874). The permit issued by the state health department for the construction of a new activated sludge plant includes, as a condition, a provision requiring sewage disinfection between May 15 and Nov. 15 each year during the construction period. This, in effect, supplements and extends the treatment required by court order.

Beaches quarantined

Because of the serious pollution of the beaches of Santa Monica Bay due to the discharge of raw sewage at the Hyperion screening plant (coarse screening only), the state health department quarantined certain of the beaches in 1943 and extended this quarantine in 1945 to cover 11.52 miles of beach line. The quarantine was based on the bacterial count of a series of samples taken from the surf at various points.

The criterion adopted by the state for safe bathing is that less than 20 percent of the samples taken over a period of time shall have 10 or more *E. coli* per cc. Beach quarantines were placed and removed on this basis.

This situation arose through the refusal of the Los Angeles electorate to vote bonds in the prewar period for treatment facilities. No construction work of any consequence has been undertaken since 1925 when a mile-long, 7-ft. dia. outfall and a screening plant with rotary screens having slits $\frac{1}{8}$ in. wide were built. The screening plant removes only 10 to 12 percent of the solids in the sewage and is of such capacity that during periods of high flow some of the sewage bypasses the plant. The ocean outfall never has been satisfactory as joints in the line opened up almost as soon as it was placed in service. Attempts to repair the line proved expensive and eventually were abandoned. Consequently, sewage leaks occur at various points in the ocean along the line.

Since the quarantine was imposed, a $10,000,000 bond issue has been passed and this, together with other money available, is being used to construct a $25,000,000 program of

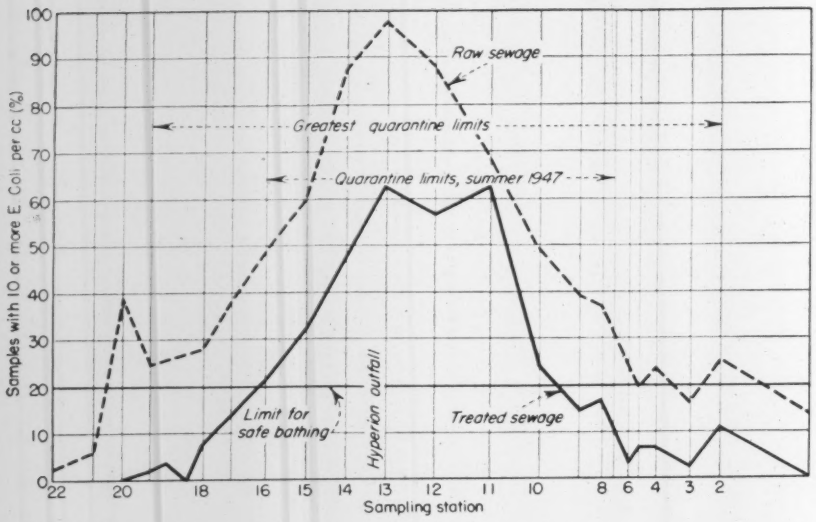

Fig. 2. Relative pollution as measured by beach samples is shown by two curves. Top curve reflects analyses taken over a 30-month untreated period and the lower curve shows sampling results during a typical month after chlorination was started in June 1947. The 20 percent line is the limit for safe bathing.

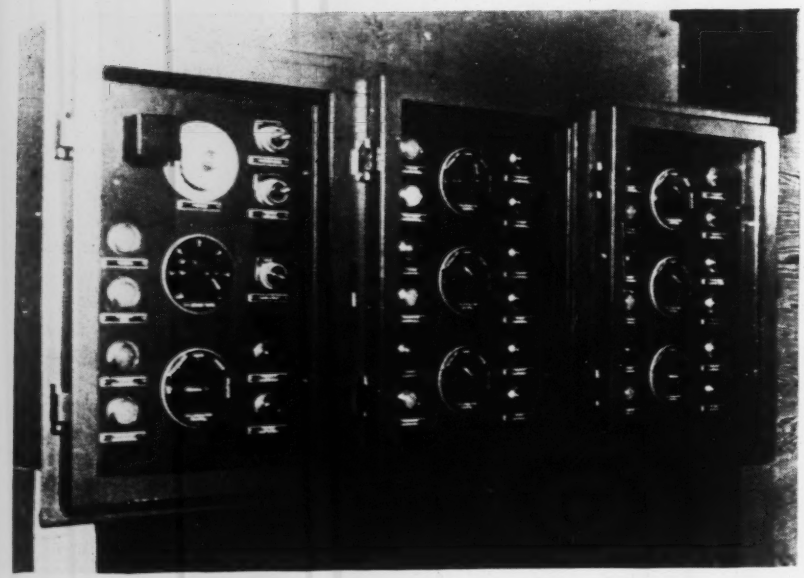

Fig. 3. This control board is the heart of the automatic operating system of the chlorination plant. Disks mounted on the clock at the upper left control the operation and permit a variation in dosage rate.

treatment and outfall facilities. Some $9,000,000 in contracts have been let and work is well under way. However, because of the extent of the program, it will be more than two years until even primary treatment is available. Some relief may be afforded by the completion early next year of a mile-long, 12-ft. dia. outfall which will discharge the sewage in a 50 ft. depth of water.

The design of the chlorinating plant was based upon a 1/1,000 scale test made in December, 1945, to determine the feasibility of chlorinating the entire flow of Los Angeles sewage (*ENR* May 16, 1946, vol. p. 802). This test was made during the winter and for summer conditions a 25 percent increase in chlorine demand was considered probable. An allowance for this factor was made in determining plant capacity.

Operation of the plant is on a 24-hr.-a-day basis with the chlorine demand being determined by pilot plant similar to that used in the test run in 1945. By means of a small chlorinator various chlorine dosages are applied to a 50-gpm. flow through this plant and residuals determined by use of the orthotolodin test.

Because flow in the system has increased since the 1945 test run and because chlorine demand in the summer was slightly greater than anticipated, total chlorine demand was some 35 percent greater than the 1945 design flow instead of the 25 percent allowed. This can be broken down to increases of 25 to 32 ppm. in chlorine demand and of 165 to 190 mgd. in average flow.

Thus, during certain periods of the day the plant, large as it is, cannot feed enough chlorine into the system. During these periods the plant is operated at full capacity in an effort to get as much disinfection as possible. However, during the parts of the day when demand does not exceed plant capacity, the plant is operated only up to demand. Excess chlorine dosage during such low periods would not be effective in reducing bacterial counts in sewage not fully treated during previous high-flow periods.

Chlorine dosage has averaged 18 tons per day. This, when compared with the plant capacity of 21 tons per day, illustrates the continuity of plant operation. Total operating costs are $1,494 per day, of which $1,165 is for chlorine.

Quarantine partly lifted in June

The plant was completed in January 1947. After several months of testing actual chlorination was started on May 15. On June 23, after the disinfection program had time to take effect and results as measured by beach samples could be studied, the quarantine was lifted from 4.52 miles of beaches. Of this amount, 2.15 miles was on the northerly end of the quarantine area and 2.37 at the southerly end.

Dosage of the sewage flow was continuous during the May 15 to Oct. 31 period except for a 16-day period (Sept. 2 to Sept. 18), during which chlorine was not available. This chlorine shortage was due solely to manufacturing problem caused by electric power shortages.

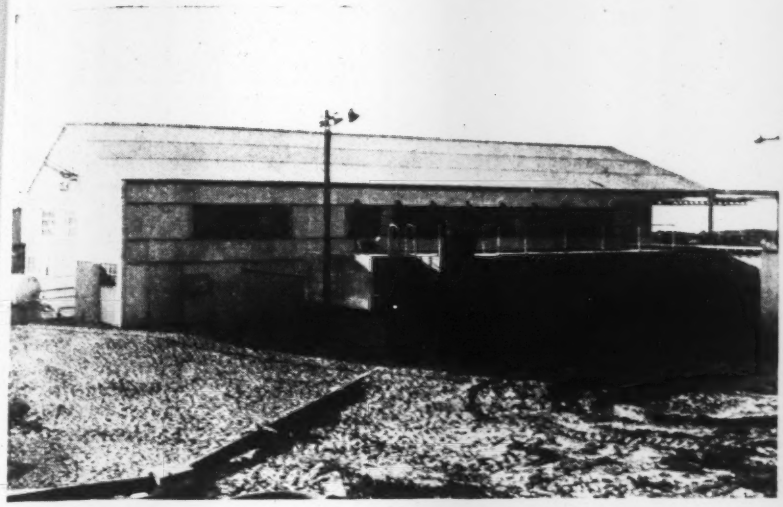

Fig. 4. This temporary building houses the chlorinating equipment. In the right foreground is a clarifier to supply settled water for chlorine dosage.

Soon after completion, the plant underwent a full-scale, 30-day test. This was conducted jointly by the city and state health department authorities and was intended to iron-out operating procedures as well as give an indication of the effectiveness of the disinfection program. Samples of surf water were taken at the various stations for this latter purpose.

Additional tests were run with chlorine applied at less than 100 percent of demand to gage the effect of a program of chemical treatment of sewers in combination with the chlorination. For some time the sewer maintenance division of the city's department of public works has been applying a chlorinated hydrocarbon in the upper reaches of the extensive sewage system. This chemical ("Cloroben") applied at the rate of 1.0 ppm. was found to relieve the septic condition in the sewers and inhibit the production of hydrogen sulphide gas and slime (*ENR* Aug. 8, 1946, vol. p. 161).

To determine if such treatment together with partial chlorination would reduce beach pollution, the chlorination facilities were operated for a period at 50 percent of chlorine demand and for another period at 25 percent of chlorine demand. The results of these tests are not available. However, they may have been inconclusive because of the short period of time taken to make them.

The chlorinating building contains six chlorinators of 6,000-lb.-per-day capacity each, six chlorine evaporators and facilities for handling and storing 70 one-ton cylinders of chlorine. An emergency, mobile, trailer-mounted chlorinating apparatus consisting of one unit of similar capacity is being used to provide an evaporator for one chlorinator. Thus, a total capacity of 21 tons of chlorine a day is available to dose the sewage flow. The installation is second in size only to that at Detroit, Mich., where nine 6,000-lb. chlorinators comprise the world's largest.

The building is temporary because it will be used only while the Hyperion activated sludge plant is under construction. When that plant is completed, the chlorination equipment will be moved to a space for permanent installation to be used in connection with the activated sludge process for either pre- or post-chlorination.

Facilities are available for connecting 15 one-ton chlorine cylinders to the chlorination system at one time. Chlorine is brought to the plant by truck as no rail facilities are available. Consequently, adequate storage space is required and almost half of the 50x100-ft. building is set aside for cylinder handling.

Chlorinators have automatic controls

The chlorination equipment is provided with automatic or "robot" controls and the dosage routine can be easily handled by one operator. Additional men are required to handle the chlorine cylinders, but this is on a one-shift basis only. Chlorinators are operated 24 hours a day.

Heart of the automatic control system is a clock to which are fixed disks permitting a variation in rate of chlorination, time period for priming and flushing, and time on-the-line for each unit. As the disks rotate, electrical impulses are transmitted to operate switches for each of the seven chlorinating systems. In turn each of these systems has a switch that can be set for manual operation, automatic operation or shutdown. Each switch is accompanied by a set of lights indicating the condition of the evaporator and the cycle of operation of the chlorinator.

The evaporators depend upon electrically heated systems to convert liquid chlorine into its gaseous state. When the evaporator temperature is too low to perform this operation, a red light for that particular evaporator lights on the control board. Another light shows whether or not the evaporator is ready to receive chlorine or for some other reason is in an inoperative condition. Two other lights provided for each system indicate the cycle of operation of the chlorinator: one light indicates when the chlorinator is being primed and the other when chlorination is under way.

Pilot-plant tests as previously described permit an operator to set the proper rate of feed by means of the disks on the clock mechanism and thus have automatic control. When this is done, his job, except for pilot-plant operation to determine chlorine dosage, is a matter of watching the lights on the control board.

Design and operation direction

The chlorinating plant was designed by the Bureau of Engineering of the City of Los Angeles under the direction of H. G. Smith. Lloyd Aldrich is city engineer. It is operated by the Bureau of Maintenance & Sanitation headed by H. P. Cortelyou, engineer-director, under the direct supervision of R. F. Brown of the sewer maintenance division.

Equipment for the plant was supplied by the Wallace & Tiernan Co., Inc., Newark, N. J. The plant was built and the equipment installed by the Hoagland-Findlay Engineering & Construction Co., Long Beach.

Behavior of Wood Under Continued Loading

Lyman W. Wood,
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***Contents in Brief**—Current analyses of extensive laboratory tests conducted over the past several years at the Forest Products Laboratory, Madison, Wis., indicate the relationship between duration of loading and behavior of timber. Practical relationships are given for deformation, stress and duration of load as applied to the safe loading capacity of structural timbers.*

Increased knowledge of the properties of wood has given engineers and architects renewed confidence in its usefulness in permanent construction. Many wooden structures or structural units still in use after 100 years or more of service testify to its durability. Recent improvements in glues and fastenings, development of preservatives against decay and borers, and increase of knowledge on moisture effects, all combine to extend the use of timber.

Satisfaction with wood as a permanent structural material depends in part upon an understanding of its behavior under continued loading, and upon intelligent provision against the effects of long-time stress. In recognition of this fact, the Forest Products Laboratory has carried out duration-of-load studies extending over a period of many years.

Although these studies are far from completion, enough information has been obtained to demonstrate some important relationships or trends. The following is a report on these trends including comments on their applications in the construction or use of timber structures.

Relation of yield to stress

Most structural materials, when loaded, undergo an immediate deformation proportional to the stress imposed, and a further deformation as the load is continued. The immediate deformation is known as elastic strain, and the subsequent increase of deformation is termed plastic strain, or yield.

Wood is one of many materials in which yield commences with low stresses. Tests of the Forest Products Laboratory disclose measurable yield in compression and tension of Douglas-fir and white oak under stresses as low as 1,500 psi., within the working stress range, and considerably below proportional limit as ordinarily determined.

Rates and amounts of yield in wood increase as unit stress increases. Furthermore there is indication that yield in tension or compression is approximately proportional to stress, but that yield in shear may be proportional to the square root of the stress.

Relation of yield to time

The relationship between yield and time under constant loading is essentially the same for all of the strength properties and for all levels of stress so far examined. This relationship can be illustrated best by the use of three charts (Figs. 1, 2, and 3).

Fig. 1 is a strain-time curve for a 1x1x4-in. Sitka spruce prism, loaded to 105 percent of its "normal strength" in compression parallel to grain. By way of explanation, "normal strength" as used here is the ultimate strength obtained or estimated from progressive loading to failure at ordinary testing rates. These rates usually are such as to result in failure in 5 to 10 min.

The curve in Fig. 1 is in three distinct parts, as indicated. The portion from *A* to *B* represents strain during the application of load. Its curvature upward indicates that yield already had begun during the fraction of a second required for the application. The portion *BC* represents yield (continuing increase of strain) at a decreasing rate, as the load was held constant. At the point of inflec-

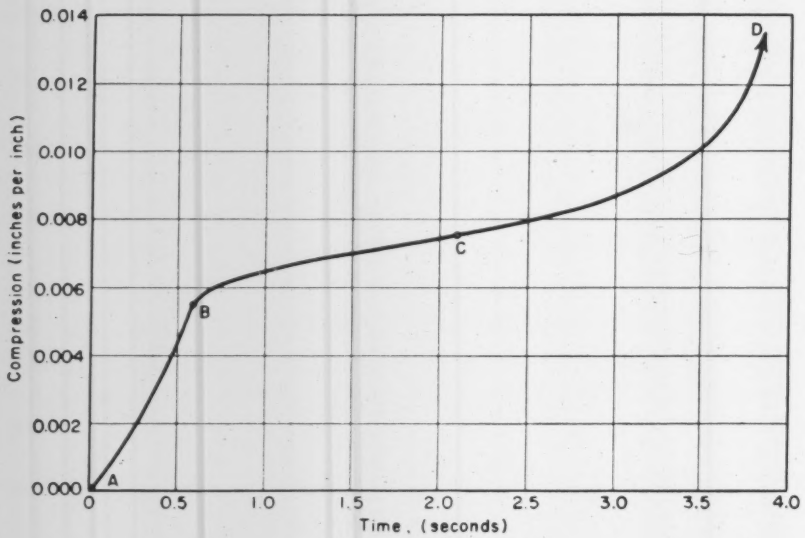


Fig. 1. Strain-time curves of a timber prism loaded to 105 percent of its "normal strength," in compression parallel to the grain, have three distinct parts—strain during application of load (AB), yield (BC), and progressive failure (CD).

tion (*C*), the rate of yield again began to increase, and yield continued more and more rapidly until failure occurred at point *D*.

Fig. 2 is a deflection-time curve for a Douglas-fir beam of structural size and character, loaded to 75 percent of its normal strength in transverse bending. Because of the scale used, the time of loading cannot be seen, and portion *AB* is practically a vertical line. The remainder of the curve, however, is similar to that in Fig. 1, from which its only important difference is in the lengthening of the duration under constant loading.

Fig. 3 is a strain-time curve for a 2x2x14-in. For Douglas-fir prism loaded to 52 percent of its normal strength in compression parallel to grain. This specimen is still under test, and yield is continuing after more than 600 days, but a point of inflection has not been reached.

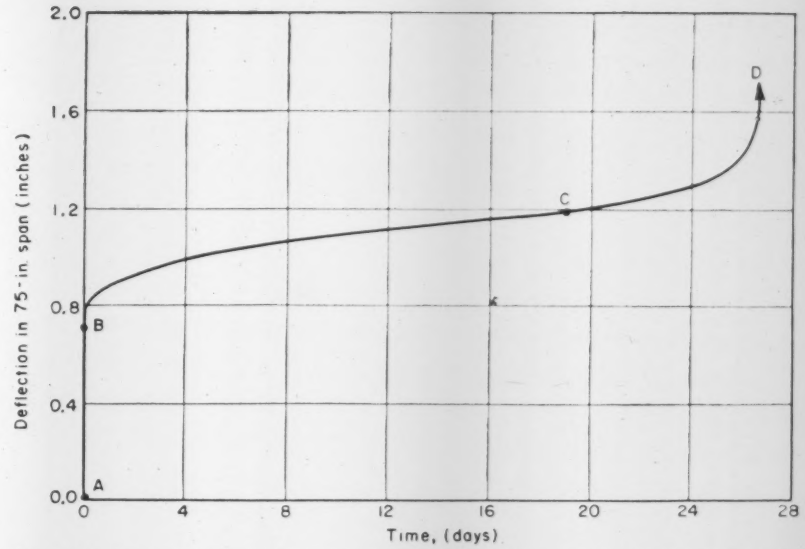


Fig. 2. Deflection-time curve for a timber beam loaded to 75 percent of its normal strength in transverse bending shows considerable elapsed time before the point of inflection (C) is reached.

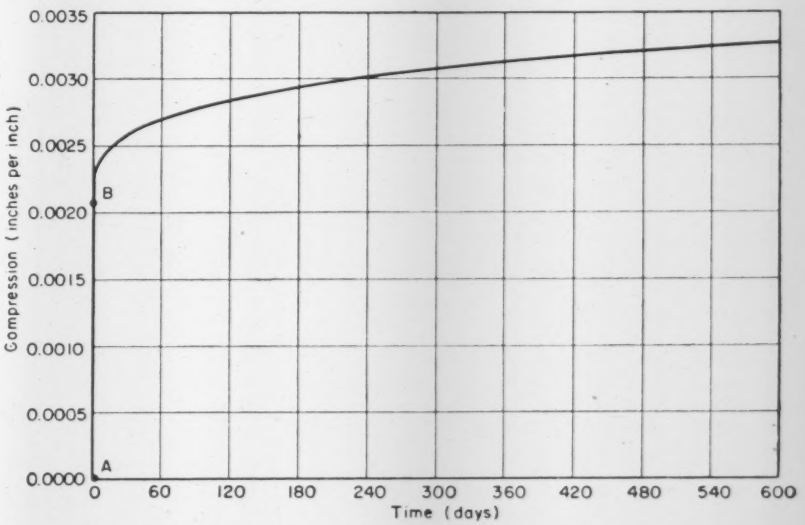


Fig. 3. Yield is continuing, but no point of inflection has been observed after 600 days of load on a timber prism loaded to 52 percent of its "normal strength," in compression parallel to the grain.

Where failure begins

The point of inflection (point *C* on Figs. 1 and 2) is significant in that it marks the beginning of failure. In all observations made so far, the duration of yield under constant loading, following the point of inflection, is less than that preceding. The two may be nearly equal (Fig. 1), while in a few instances the inflection point has been followed immediately by failure.

In many of the tests, duration following the inflection point is about half of that preceding. There is a tendency for the inflection point to hold at about the same level for any one species, and type and condition of specimen, with failure ensuing when that level of deformation is reached, whether in a few seconds or several months.

Strain-duration curves, such as those illustrated, have been obtained in tension and compression of Douglas-fir and white oak, bending of Douglas-fir and Sitka spruce, and shear of yellow birch. Similar relationships have been observed at the Forest Products Laboratory on yield of a timber joint with ring-connector fastening, and elsewhere in long-time loading of full-size trusses.

Continuing yield at a decreasing rate under constant stress is characteristic also of other structural materials, including certain glues used in structural assemblies, concrete, and to a limited extent, even steel.

When load is removed from wood, the elastic strain is regained immediately. There is, in addition, a recovery of a portion of the plastic strain, relatively rapid at first, and continuing more and more slowly for considerable periods of time. The recovery curve is approximately an inverted image of the first part (*BC* in Figs. 1 and 2) of the yield curve. This effect has been observed in tension, compression, and bending of Douglas fir, and is expected from like treatment of other structural woods, although little is known of its nature and extent.

Relation of duration to stress

Figs. 1, 2, and 3 indicate how the time from application of the load until failure may vary from a few seconds under high stress to many months or even years under low stress. Duration of yield under constant loading is related inversely to load.

This relationship is exemplified by Fig. 4, representing data from a partly completed project at the Forest Products Laboratory on transverse bending of small clear specimens of Douglas-fir. In this chart, the load is expressed as a percentage of normal strength, and the duration appears on a logarithmic scale. The straight line indicates a proportionality between load and the logarithm of duration. The solid portion of the line indicates the limits of test data in this project. Prolongation of the line in the direction of higher load is verified by other tests, while prolongation in the direction of lower load as yet is unproved. The data were obtained under laboratory conditions of nearly uniform temperature and humidity; the effects of variable conditions in actual service are not yet evaluated.

It may be noted in Fig. 4 that each decrease of about six in load percentage multiplies the duration by ten. Durations of Sitka spruce in compression and in bending have relationships to stress much the same as those shown in Fig. 4.

Repeated constant loads

Current work at the Forest Products Laboratory includes tests with repeated constant loads in transverse bending of Douglas fir. It has been found that successive repetitions of the same load separated by periods of recovery cause successively increased deformations. These successive deformations lead finally to failure, tracing a curve of the same kind as the curves shown in Figs. 1 and 2.

The cumulative factor in successive loadings is still in process of evaluation, but it appears that the sum of the periods under intermittent load until failure is somewhat greater than the duration to failure under a continuous constant load at the same stress level.

Structural applications

Relationships of strain, or deformation, to stress and to duration have a number of practical applications in structures that include load-bearing timbers. A few of these will be discussed here.

Timber engineers have recognized for some time that safe long-time loads are less than safe short-time loads, but the fact will bear emphasis again. For long-time loading, the Forest Products Laboratory recommends a reduction to $\frac{9}{16}$ (about 56 percent) of short-time loading strength. It may be noted that the 56 percent ratio in Fig. 4 corresponds to about 27 years of full load. The duration of loading will show some variation among species and strength properties, and may be affected by variable conditions in service.

As previously mentioned, when load is applied to a structural timber, the immediate or initial deformation subsequently will be increased by yield, rapidly at first, then more slowly—the amount of increase depending upon the stress and the elapsed time. This is true in all types of loading investigated, whether tension, compression, shear, or bending. The increase of deformation (yield) becomes very slow or almost imperceptible at low loads.

Under heavier loads yield continues at an appreciable rate and finally at a rising rate to failure. Yield up to 50 percent of the initial deformation may occur in about a year's time (Fig. 3), and are possible up to 100 percent or more without failure.

Yield, therefore, must be taken into account in any timber designs where it is important to limit deformations, and particularly in the more elaborate structural assemblies where misalignment from continued deformation may result in important secondary stresses. Instances of trouble arising from failure to take yield into account have already been reported.

The yield characteristics of wood have long been recognized by the American Railway Engineering Association in its recommendation* that only one-half of the published value for modulus of elasticity be used in computing the deformation of loaded timbers. By this practice, initial deformation becomes only half of the permissible amount, and allowance is made for a substantial subsequent increase in deformation, or yield. The *Wind Handbook* (p. 151) of the U. S. Department of Agriculture also recognizes this fact.

Occurrence of yield, even after a long period of time, does not necessarily imply the near approach of failure. If yield occurs at a decreasing rate (portion *BC* of the curves in Figs. 1, 2, and 3), a long duration of continuous load or a longer time of intermittent load may still be ahead.

A rate of yield remaining uniform for some time indicates approach to the inflection point in the strain-time curve and is a danger signal. When the rate of yield begins to increase, the inflection point has been passed and failure is imminent. These relationships are useful in the observation of the behavior of timber structural units or assemblies in which overloading or deficiency of strength is suspected.

Hypothetical example

Observations of yield may be illustrated by a hypothetical example. A timber beam supporting a section of

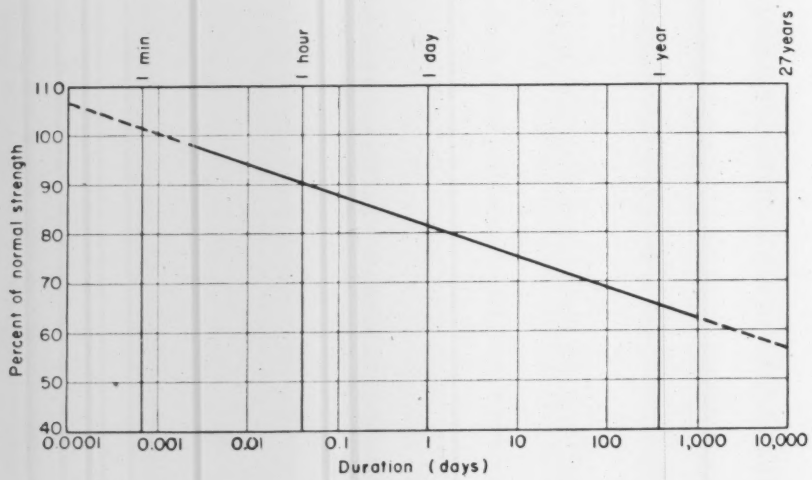


Fig. 4. Duration tests of Douglas-fir in bending under various loads indicate that loading to 56 percent of "normal strength" will cause failure in 27 years.

* "Specifications for Structural Wood Joist, Plant, Beams, Stringers, and Posts," Amer. Railway Eng. Assn. *Bulletin* 314, p. 1193, 1929.

loaded warehouse floor may show an immediate deflection of $\frac{1}{4}$ in. which increases to $\frac{5}{16}$ in. in a month. After a year's time the deflection may have increased to $\frac{3}{8}$ in. and in 2 years' time may be scarcely more. This behavior is an indication of durability, even though the deflection in 10 years' time may have become as much as $\frac{1}{2}$ in.

But at some later time it may be observed that deflection is increasing at a uniform rate of $\frac{1}{16}$ in. per year, or that the increase in one month is as much as was that in the previous year. When this occurs, failure is imminent, and the beam should be unloaded or strengthened without delay.

It has been found that structural units in unstable equilibrium under load may sustain the load for a short time, but fail by buckling when loading is continued. Timber columns in the intermediate or long-column classes (ratio of length to width greater than 11) are an example.

Another example is the deep, narrow beam which may be stable under short-time vertical load, but which has been observed to fail by lateral deflection with continuance of the same load. Lateral stability is a most important factor in timber design for long-time loading.

Court Holds Owner Liable for Damage In Collapse of Old Crib Dam

A PENNSYLVANIA court decision of interest to civil engineers is that of the Borough of Austin *versus* the A & P Corrugated Box Corp. having to do with damage caused by the collapse of a dam following a very heavy rainfall on July 18, 1942. The owner of the dam was held liable for the damage caused in the Borough of Austin because of neglect to keep the dam in proper repair.

The borough sued the defendant company for the recovery of damages to certain of its streets which it alleged resulted from flood waters caused by the negligence of that company in its care and maintenance of a water storage dam on the North Branch of Freeman Run about two miles north of Austin, Pa. The trial of the case in the Court of Common Pleas of Lycoming County, Judge D. M. Larabee, presiding, and resulted in a verdict in favor of the plaintiff for $35,000.

Timber crib dam

At the time of the collapse the dam was operated and maintained by the Williamson Pulp & Paper Co., whose name was later changed to the A & P Corrugated Box Corp. The dam was formed of a chain of timber cribs which were filled in with broken rocks and shale. Over the top was a plank "bucking" to prevent water going through the cribbing, and the entire top of the dam was then covered with earth several feet in depth. There was a central spillway of heavy plank.

The dam was 580 ft. in length across the top and 32 ft. in height. The reservoir had a capacity of 65,000,000 gal. at the spillway crest.

Caused disastrous flood

After a very heavy rain storm continuing about 14 hours, the center of the dam in and about the spillway section suddenly gave way and a large volume of water rushed down the stream into the Borough of Austin. The current was of sufficient depth and force so that dwellings and other buildings were swept from their foundations and floated down until they lodged against a bridge. The concrete and brick paving on some streets was torn up and the streets washed out in places. A switch engine was carried down stream 1,000 ft.

The defendant maintained that the flood was an act of God and disclaimed responsibility for the damage, but it was proved in court that the defendant company had been warned by competent authority and in ample time that the dam needed repair but that nothing had been done about it.

The court instructed the jury that when the defendant took over the supervision and care of the dam it knew, or should have known that in thus impounding a large volume of water it owed a duty to maintain the dam in a proper state of repair, bringing to its construction, maintenance and repair the engineering knowledge and skill ordinarily known and practiced in such cases.

C. E. Weigle, chief of the division of dams of the Pennsylvania Department of Forests and Waters, had testified that more than a year before the dam failed he had filed a report in which he found evidence that the timber in the center of the dam had decayed badly in the 30 years it had been in place, that the entire structure had settled, and it leaked badly.

The principal findings of the court were as follows:

Where a flood is caused by the collapse of a dam following a very heavy rain storm, the owner of the dam is liable for any resulting damages if it was negligent in the operation and maintenance of the dam and if that negligence combined or occurred with an act of God to produce the injury, but if the rainfall was an act of God and if it was of such overwhelming and destructive character as by its own force, and independent of defendant's negligence, to produce the injury complained of, then the owner of the dam is not liable for damages claimed.

Evidence of settlement and leakage in a dam, brought to the notice of the owner, and of other deterioration of a dangerous nature is sufficient to justify a finding by a jury that the owner was negligent in not correcting the defects the court said.

Other findings of the court

In determining whether a rain storm and the attendant high water which caused the collapse of a dam was an "act of God", there must be taken into consideration such factors as the nature and duration of the rainfall, the size and area of the watershed, the typography and past experience as to precipitation.

Where a flood following the collapse of a dam injures borough streets, the owner of the dam is liable to the borough for the amount required to restore the streets to the same condition they were in immediately before the flood.

In assessing damages for repairing streets damaged by a flood, the actual cost of repairs and reasonable estimate of repairs not yet made are admissible, but further damages unsupported by competent evidence cannot be awarded.

Fig. 1. Architectural rendering shows how the Harvey S. Firestone Memorial Library on the Princeton University campus will harmonize architecturally with adjacent buildings.

Flexible Plan Attained for Library Through Modular Design

***Contents in Brief**—Space for human occupancy and book storage are interchangeable in Princeton University's new Harvey S. Firestone Memorial Library. The design was based on a 3-ft. module—length of a typical book shelf—and a 4-ft. 6-in. module—spacing on centers of book stacks and aisles. To avoid delays due to postponement of steel deliveries, reinforced concrete was employed in the lower three stories. Structural steel framing with ribbed concrete floors is used in the three stories above, and masonry in the load-bearing walls of the tower over the entrance.*

WHEN lack of structural steel threatened to delay construction of the $6,000,000 Harvey S. Firestone Memorial Library on the Princeton University campus at Princeton, N. J., the lower three stories were built of reinforced concrete and the upper three with steel. The dual system proved to have several advantages, aside from enabling postponement of steel deliveries. These can be fully appreciated only after analysis of the effect upon the structural frame of modular construction, which was utilized in design to secure a building adaptable to changing needs.

Primary consideration in planning this building, which is expected to be completed for the fall term of 1948, was students' requirements. Therefore, an unusually large number of facilities is incorporated for the convenience of book users.

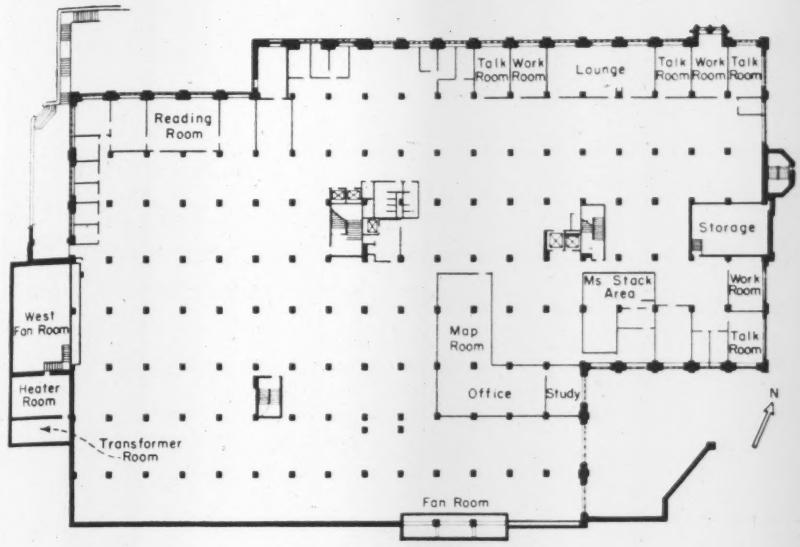
Book collections are to be as nearly unified in location as possible, and students will be able to go directly to any part of the stacks without hindrance. More than 500 individual cubicles, or carrels, each of which will serve as the private research office of a student, will be provided. Total seating accommodations for about 1,700 readers are planned including many seminar and conference-lounge rooms. And the various areas for books, readers and library services have been placed in carefully thought-out juxtaposition.

Requirements of library administration have not been overlooked, however, ample space being provided for offices and other work areas. Full weight was also given in the design to the librarian's desire for large uninterrupted book-stack areas, where the serious problems of expansion and reshelving could be minimized.

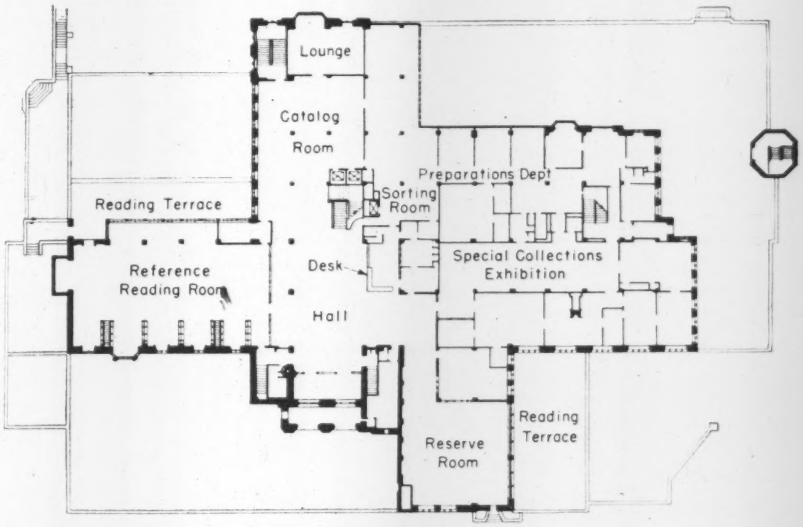
Main components of library

In effect, the library, which will have a book capacity of 1,800,000 volumes, may be considered composed of three parts, coinciding with the portions of the building in which different structural materials are used —three lower stories of reinforced concrete, three-story superstructure of structural steel and a masonry tower extending 50 ft. above the superstructure.

The three lower floors are located below the entrance-floor level. Designated in descending order as floors A, B and C and measuring about



STACK "A" FLOOR PLAN



FIRST FLOOR PLAN

Fig. 2. Floor plans for the library were based on modular design to achieve flexibility of layout. The designers sought to maintain proximity of students and instructors to books and allow free access to stacks.

350x225 ft. each, with the long dimension from east to west, they are intended to house the principal bookstacks, most of the carrels, browsing alcoves, offices, seminars and conference rooms (Fig. 2). A truck entrance is provided on the east side at B level of sufficient size to shelter a large-size moving van so that books may be unloaded indoors.

On the south side, floors A, B and C will be below grade, but on the north, and to some extent on the east and west, they will be above grade and hence will have access to natural light. Windows will have aluminum sash.

Upon the broad concrete base rises a superstructure of three additional floors of much smaller area. In ascending order, these are designated as floors 1 (main entrance floor), 2 and 3. This superstructure supports the load-bearing masonry walls of the tower.

Architecturally, the tower serves to emphasize the main entrance, which is located near the center of the south side—the direction from which most of the users will come. Also, since the library is on the university campus and architectural harmony with adjacent buildings is desirable, the tower builds up the composition with the chapel on the south (Fig. 1) and the old Pyne Library to the west.

Quarried near Swarthmore, Pa., a warm gray, mica schist granite was chosen for the tower and for all exterior walls above grade to harmonize with the Gothic treatment of nearby buildings.

On the main floor, near the front entrance, is the circulation desk, from which the wings of the library radiate, forming a cross with offset arms (Fig. 2). Each wing houses on the first floor one element of the plan with which the average visitor is likely to have contact—the large reference reading room; catalog room; reserve book room; and the special collections and exhibition galleries, principal administrative offices and preparations department, through which all acquisitions are processed.

Because of the two-story reference and reserve rooms at entrance level, floors 2 and 3 are T-shaped in plan and somewhat smaller than the first floor. Floor 2 is given over largely to special collections, and Floor 3 is similar in principle to floors A and B in having modular bays and permitting juxtaposition of seminars, carrels and book classifications. Also on Floor 3 is a faculty conference-lounge room large enough to accommodate the entire faculty of the university.

Vertical circulation between floors is provided at several points, the most important being the large stair across from the entrance and just beyond the circulation desk (Fig. 2). Back of this stair are two passenger elevators. A similar bank of stairs and elevators is located near the east end of the building, where it will be accessible to the administrative and special collections departments.

A service elevator brings the total number of elevators to five. In addition, there are a book conveyor, or lift, and pneumatic tubes.

Shelf length adopted as module

During the design of the library, the necessity for utmost flexibility to meet changing needs was kept in mind. To achieve this aim, modular construction was resorted to. For one direction, a standard unit for the structural bay was adopted based on the 3-ft. length of a typical library shelf. In the perpendicular direction,

Fig. 3. The lower three stories of the library are of flat-slab reinforced concrete construction and the upper three are framed with structural steel. Exterior walls are masonry. The main entrance is at the level of the bottom of the steel frame, and a truck entrance is at B level (foreground).

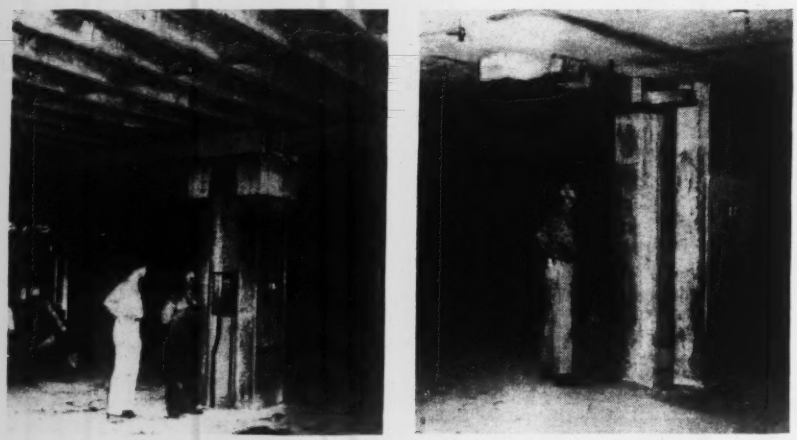


Fig. 4. Two-piece concrete columns are used in the lower stories, with the space between the sections occupied by ventilation ducts. Column capitals are used at the first floor level (left) but are neither necessary nor desirable at the A level (right).

the unit chosen was 4 ft. 6 in.—nominal spacing on centers of stack ranges and aisles. These modules were carried throughout, with minor exceptions. As a result, through the use of movable partitions, almost any bay can easily be changed from its present purpose to some other.

Designed for a live load of 125 psf., the building can accommodate stacks on all floors. Thus, in almost all bays, the module led to 24-ft. 5-in. and 27-ft. 5-in. spacing of columns in one direction and 13-ft. 4-in. spacing in the other, including allowance for clearance.

Like the structural system, the ventilation system is also laid out on a modular basis, so that each bay is handled as an independent unit. Thus, a bay anywhere on Floor A, for example, may be transformed from book storage to a seminar room or to a group of files by the university's own maintenance force merely by local adjustment of the ventilating and electrical services and the installation of the requisite partitions.

The library is designed for complete ventilation with filtered air, but the refrigerating units for summer cooling are not being installed immediately, except in a few areas where the storage of manuscripts or other fragile material demands a closely controlled climate. Two fan rooms located below the B level will feed the lower three stories, and two fan rooms on the roof will serve the rest of the building.

In the lower three stories, a ceiling height of 8 ft. 5 in. was adopted. Although greater than required for 7-ft. high book stacks, it gives better circulation of air and distribution of light than a lower ceiling and permits passage of ventilation ducts. Also, it makes possible addition of another shelf, bringing the total height of stacks to 8 ft.

Utilization of natural light where available made it feasible to provide enormous space for book shelves inside an outer perimeter of seminars, conference rooms, offices and carrels, all in close proximity. Browsing alcoves will be formed in the stack areas either by furnishing tables and chairs in open spaces or in partitioned-off regions, thus relieving the monotonous appearance of row-upon-row of stacks. Floors A, B and C total about 4½ acres, and could, if entirely filled with books, provide for well over 2,000,000. Thus, the ideal of a unified stack, with considerable room for future expansion, and proximity of student and instructor to books has been realized.

Two types of floor system used

Since the book stacks may reach to the ceiling, floors A and B were designed as flat slabs, 12 in. thick throughout, both to meet the headroom requirements and to achieve economy. The underside of these floors will be left exposed, painted but not plastered. Under Floor 1, however, a suspended ceiling will be used to cover the ventilation ducts. Thus, capitals could be used at the tops of the columns at this level, as long as they did not protrude below the suspended ceiling, but not at the A and B levels where they would interfere with the stacks.

Floor C is a 6-in. reinforced concrete slab cast on the ground on a base consisting of 6 in. of compacted gravel and 4 in. of structural tile. One porous tile drain is provided underneath the floor in each bay.

From the first floor to the roof, where structural steel beams are em-

Fig. 5. A one-story high truss spanning across two bays supports a column that terminates at Floor 3. Concrete for Floor 1 was delivered in buggies (foreground) and vibrated internally in place.

ployed, the floor system consists of concrete ribs, 8½ or 10½ in. deep by about 5 in. wide, spaced 25 in. c. to c., with a top slab 2½ in. thick (Fig. 4 left). A 4-in. wide distribution joist is provided in the center of each bay.

Most floors will be covered with asphalt tile, but wood will be used in the main rooms, such as the entrance hall and reference reading room.

Metal pans were used for casting the ribbed floors and plywood forms for the flat slabs, columns and foundation walls. Concrete was designed for an allowable unit stress of 3,000 psi., steel for 20,000 psi., and footings for 12 tons per sq. ft. on shale.

Delay avoided by using concrete

Original plans called for designing all of the building, except possibly the tower, of structural steel. However, when it appeared that construction might have to be postponed because of difficulties in obtaining steel, resort was had to reinforced concrete for the lower three floors (Fig. 3). In this way, work on the lower levels was enabled to be started on time, and steel for the upper stories was delivered so that their construction was not delayed on this account.

When the designers attempted to use ordinary solid concrete columns in the lower levels, however, they found that the openings for ducts that would have to be provided in the floors alongside the columns would complicate the flat-slab design. If the columns were made hollow, the perimeter would have to be cut to permit the ducts to pass through, and just as much concrete would have to be used in the entire outer shell as if the openings were used for the full length of the columns. These considerations led to the use of a two-piece column extending from just below B level to the first floor (Fig. 4).

Two-piece column proves useful

Column dimensions were selected to accord with the module. A typical column is 2 ft. 4 in. wide and consists of two 1-ft. thick sections with a clear distance between of 13 in. The space between the sections will be occupied by ventilation ducts and electrical conduits and will be covered.

An investigation of the shearing stresses around the perimeter of the columns at the A and B levels revealed that the bifurcated columns provided sufficient shear area without the use of capitals. However, capitals were needed at the first-floor level for transfer of the load from the steel columns immediately above to the concrete columns. These capitals have the same depth as the ducts, so that they also will be concealed by the suspended ceiling.

Interior and exterior columns were given the same overall dimensions to simplify formwork and fit in with the module. Thus, although more concrete is used in cases where the load would permit smaller columns, a saving was made in reinforcing steel. Furthermore, nothing would be gained by using smaller columns where a fraction of a module could not be utilized.

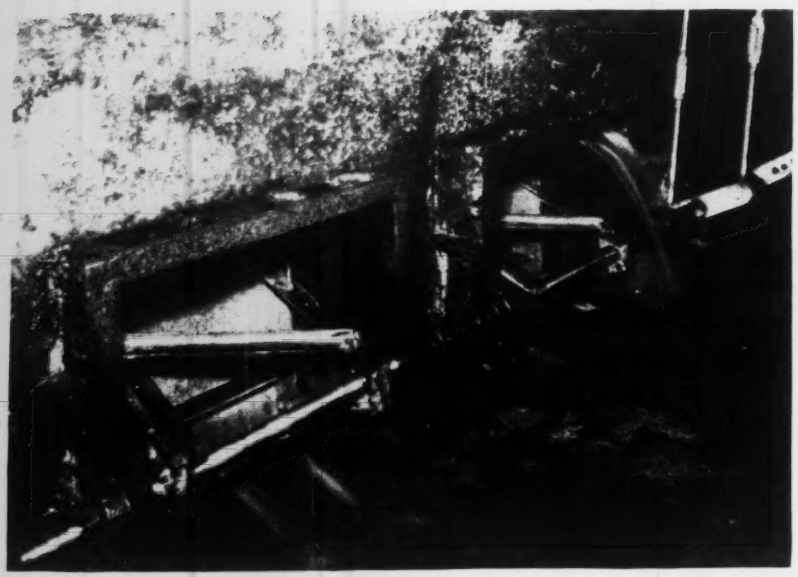
Tower and hall bays different

It was mentioned previously that there were some exceptions to the use of the typical modular bays. One occurs in the region of the tower where it was necessary to provide two extra columns to support the heavy load. Another exception occurs in the first story around the entrance hall where a large unobstructed floor area was desired, and the columns could not run through.

To provide the required open area, one of the columns is carried at the third floor on a 10-ft. 6-in. deep truss spanning 36 ft. 8 in. (Fig. 5). Chosen for economy and to meet space requirements, the truss was designed to support a 12-in. WF 65-lb. column with a load of 419 kips. It consists of a top chord at Floor 3, composed of two 15-in. channels back to back, a bottom chord at Floor 2 made up of two 18-in. channels back to back and 14-in. WF 78-lb. diagonals. At other places, second-floor panels at the edge of the entrance hall are hung from girders above.

During the planning stage, a full-size model of four typical bays was erected to try out various types of lighting, shelving and flooring materials and arrangements, as well as different ceiling heights and color schemes. Many useful data were derived from these studies, particularly with respect to lighting, for which a comparison was made of the efficiency, cost, uniformity of light and comfort of a large number of fixtures. While a predisposition existed to use fluorescent lighting, the extensive tests produced widespread agreement among designers, faculty and library staff that incandescent lighting met the various qualifications better, and it has been adopted virtually throughout the building.

Architects are R. B. O'Connor and W. H. Kilham, Jr.; structural engineers, Weiskopf and Pickworth; and mechanical engineers, Meyer, Strong & Jones, Inc. General contractor is Turner Construction Co., Howard A. Schroedel superintendent.



General Electric Co. photos

Intercepting-sewer diversion gates (left) are operated by the dispatcher in the pumping station 1½ miles away (right).

Sewer Gate Operation By Remote Control

L. L. Bradish
Engineer in Charge of Sewer Control
The Sanitary District of Chicago
Chicago, Ill.

F. C. Lorenzen
Industrial Division
General Electric Co.,
Chicago, Ill.

***Contents in Brief**—Faced with the difficult task of providing sufficient inspection and maintenance to insure proper operation of a great number of diversion structures, the Sanitary District of Chicago, has devised a remote-controlled, supervisory system to actuate diversion gates and record continuously positions of and hydraulic conditions at the gates. Governing three gates, the first installation has proved so successful that plans are being made for fifteen additional supervisory units.*

To PROVIDE OPERATION quickly responsive to flow and eliminate delayed maintenance, three mechanically-operated, radial diversion gates governed by a remote control system have been installed on a combined sewer at Stickney, Ill., by the Sanitary District of Chicago.

In an area of 448 sq. mi. with a population close to 6,800,000, the Sanitary District contains 178 miles of intercepting sewers, nearly all of which are of the combined type. Such a system naturally embraces a great number of diversion chambers. To maintain their effectiveness, regular inspection and maintenance must be provided at frequent intervals. As this is an expensive task, the Sanitary District has studied means of indicating and controlling the positions of gates from a central point. This installation—which has greatly increased the efficiency of handling sewage and storm flows—is a result of that study.

Control gates in the diversion structures are designed so that the dry-weather flow plus a percentage of the storm water is diverted to the interceptor during storms and the balance of the storm runoff discharged to adjacent streams.

The effectiveness of the existing control structures is limited by hydraulic conditions in the various structures. At times gates become blocked by debris, and raw sewage is diverted to adjacent streams without proper dilution. This condition is remedied only by periodic sewer inspections and considerable time may elapse between blocking of the control gates and the correction of the condition.

What control gates do

To remedy this condition, a system of supervisory-operated sewer control structures was designed by sanitary district engineers, having the following features:

Control gates are opened and closed from a central operating station.

Positions of gates in motion are registered on indicating meters in the central station.

Positions of gates at rest are indicated by use of a selector switch.

Water levels in the control structures are indicated continuously.

Red lights in the central station indicate when torque limit switches are open.

Gate-operating circuits are broken and alarms are rung in the central station when unusual conditions are encountered at the gates.

Control gates are operated by means of two-wire, leased telephone circuits.

The substation is located in the sewer control structure at 43rd and East Avenues in Stickney, Ill. The dispatcher's cabinet is located in the pumping station of the West-Southwest Sewage Treatment Plant located one and a half miles east of the control structure.

Supervisory equipment used

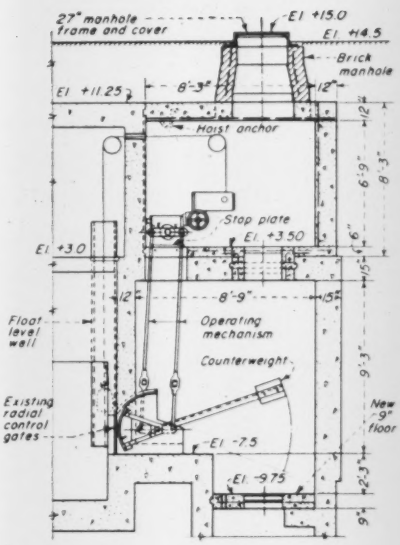
Automatic supervisory control equipment of the code selector type was furnished. It consists of a dispatcher's control cabinet with indicating instruments, operating buttons and supervisory relays, and of substation control equipment in a waterproof cabinet with potentiometers for determining gate position and liquid level separately mounted.

Meter readings are conveyed by means of potentiometer transmitters, one of which is float-operated and the other connected to the gate mechanism. Either reading may be transmitted continuously after selection by the dispatcher, and the gate can be operated by remote control even when the gate position reading is being transmitted.

The motor-operated gate mechanism includes a torque switch that will operate if the gate closes against some obstruction. This switch will stop the gate motor, transmit an alarm indication to the dispatcher's office, and prevent further closing of the gate. In this case, the dispatcher must activate the control to back the gate away from the obstruction and to allow the torque switch to close its contact before another closure attempt is made.

How codes are used

Codes for control operations and indications are transmitted by interrupting the continuous metering current to produce a number of impulses in rapid succession. Combinations of long and short pauses between constant-length impulses make up the codes. The continuous metering circuit provides line-wire supervision by dropping out the line relay at the dispatcher's office and sounding an alarm if the line circuit is de-energized for a time interval of longer duration than required for transmitting one impulse of the code.



Existing radial control gates in the diversion chamber are actuated by means of remotely controlled, electrically powered mechanisms.

The dispatcher's office equipment is installed in a steel cabinet for wall mounting, with a hinged door which contains the control panel. On the panel are indicating instruments, indicating lamps, selection and control push-buttons and the supervisory relay unit in a drawout case. On the inside of the case are the line relay, control power transformer and rectifier, fuses, alarm bell, and terminal block.

The substation equipment, with the exception of the potentiometer transmitters, is installed in a water-proof, wall-mounted cabinet of submersible construction. This equipment includes the supervisory relay unit in a drawout case, auxiliary control relays, line relay, control power transformer and selenium rectifiers, fuses, voltage stabilizer for power supply to potentiometer transmitters, adjustable resistors for potentiometer transmitter circuits, control power switch and terminal blocks.

The supervisory and remote metering equipment is designed to operate over a pair of leased telephone wires forming a loop circuit between the dispatcher's office and the outlying station. Voltage is applied to the loop from one of the potentiometer transmitters at the outlying station, and the line relay at each station and one of the indicating instruments are connected in series in the loop.

Hourly readings of gate position and water level are recorded in the dispatcher's office.

At present only one sewer control structure is in operation. However, plans are being made for installation of fifteen additional supervisory control units in intercepting sewers serving the West-Southwest Sewage Treatment Plant. When these units are installed, about 70 percent of the sewage flow to the plant will be under continuous inspection and accurate control.

Quantity of flow calculated

The control will provide the following services:

Calculation of the quantity of flow through the gates.

Adjustment of the gates to the desired flow.

Diversion of all or any portion of the flow.

Observation of any abnormal condition in the control structure such as rainfall in any area or a blocked control gate.

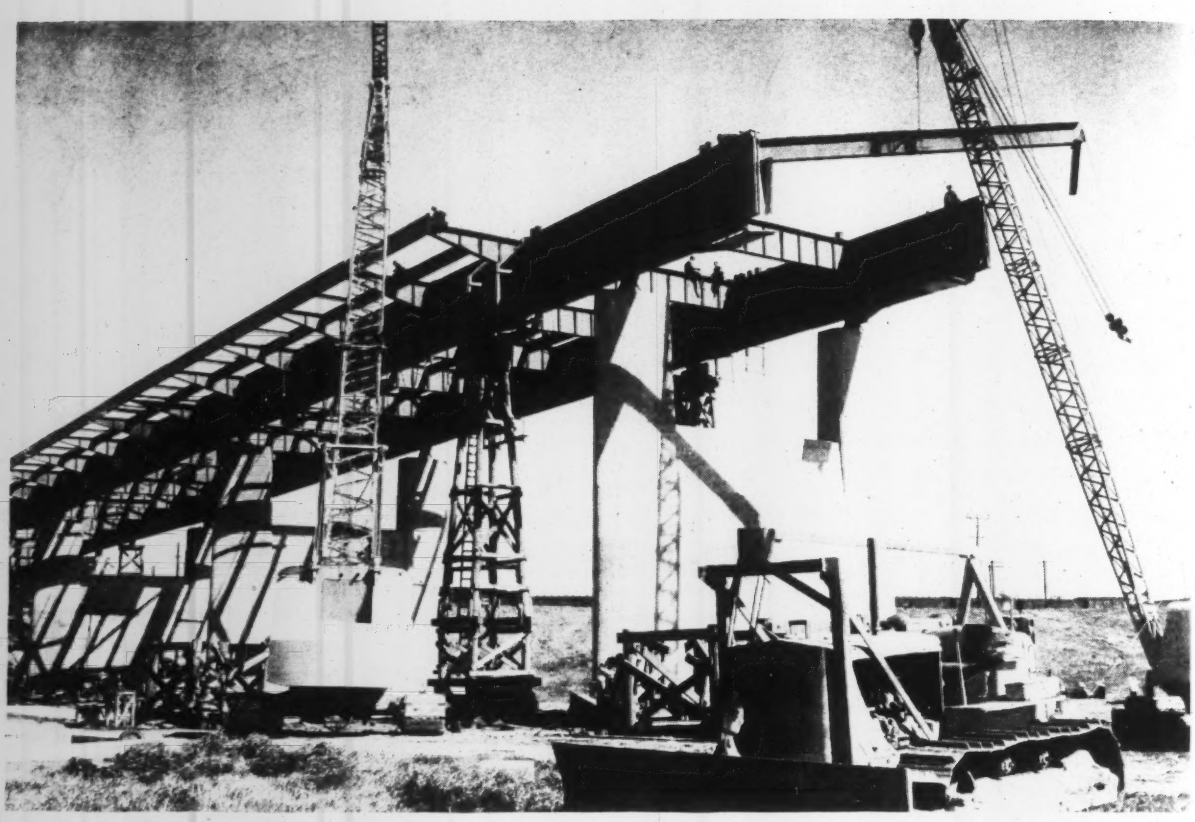
Clearance of a blocked control gate by opening and closing the gate.

Diversion, by gravity instead of pumping, of large quantities of storm water, resulting in a saving in pumping costs.

Diversion of large quantities of water from the West-Southwest Sewage Treatment Plant in case of emergency.

The supervisory control system was worked out by L. L. Bradish under the general direction of W. A. Dundas, general superintendent of the Sanitary District, and W. H. Trinkaus, chief engineer. Control gates and control structures were designed by P. A. Girad, and J. W. Towne, engineer and assistant engineer of sewer design, respectively.

Electrical work was designed and installed under the direction of J. T. Hawley, electrical engineer, and R. R. Pinkerton, electrical construction engineer. The Edwards Electric Co., Chicago, Ill., made the control installation.



Crawler cranes of two different capacities divide the heavy and light lifts of bridge steel between them. Cantilevered floorbeams are a feature of the design of the highway bridge over the Feather River at Marysville, Calif.

High Girders Bridge the Feather River

Ralph W. Hutchinson
Associate Bridge Engineer,
California Division of Highways, Sacramento, Calif.

***Contents in Brief**—An outstanding example of postwar highway bridge practice in California, the new bridge at Marysville, Calif., uses steel girder spans ranging up to 161 ft. long. Girders were set in place bodily by crawler cranes. A 70-ft. deck height was required to allow clearance over a railroad on top of a levee; compound vertical curves in the deck were part of the architectural treatment suited to height and size of a dominant structure.*

ONE OF THE FIRST major postwar bridges to be built by the California Division of Highways is the one costing almost $2,000,000, completed in August, 1947, across the Feather River at Marysville, Calif. It is to provide long-overdue relief for an old narrow bridge half a mile downstream which connects the interdependent communities of Marysville and Yuba City, important centers in California's "Peach Bowl." In 1941, a 10-hr. traffic count showed that nearly 23,000 vehicles, of which 20 per cent were trucks, used the old bridge.

To handle this heavy traffic and expected increases, the new bridge has a four-lane, divided roadway. Lanes are 12½ ft. wide and opposing traffic is separated by a 4-ft. median strip. There is a 5-ft. sidewalk on either side.

The Feather River in this locality is confined to a half-mile width by levees, which are 25 ft. high. Along the top of the Marysville levee run main line tracks of the Western Pacific Railroad, which are also jointly used at this point by the Sacramento Northern, an electric interurban. The bridge was required to pass over these tracks with a clearance of 23 ft. 6 in. This added a hundred feet to the length of the bridge and raised the grade at the point that was most critical because of grades required to make connections with city streets. The steepest grade occurs at the abutment adjacent to the tracks.

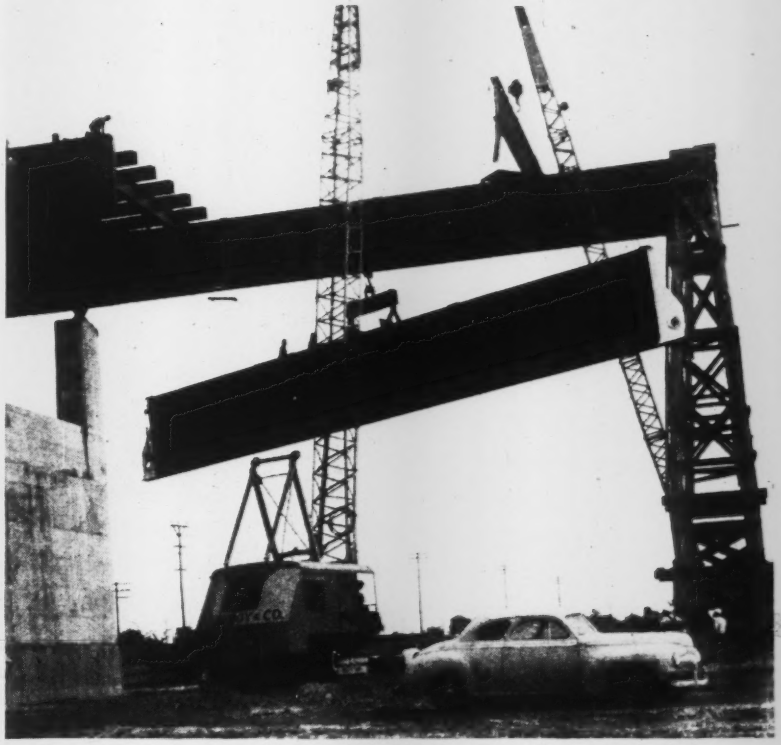
For its entire length the bridge deck is on a series of three compound vertical curves, starting with a 6 percent

grade near the railroad tracks and ending with 2½ percent at the opposite abutment. The result is an unsymmetrical but pleasing vertical curve with the crown at the one-third point.

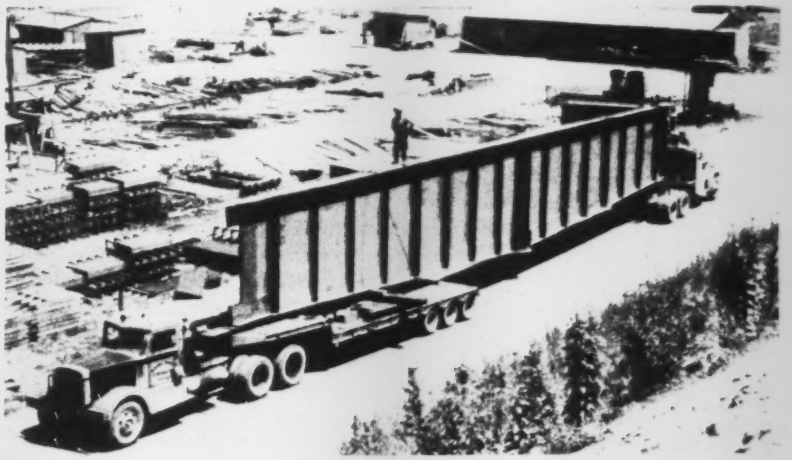
Meeting these controlling requirements called for a rather monumental bridge 2,693 ft. long with a deck more than 66 ft. wide, rising to nearly 70 ft. above the river bed. This combination of conditions put a special requirement upon the designers in that the choice of bridge type involved cost comparisons weighted somewhat by the intangible necessity of building something whose appearance would be suited to so dominant a structure.

In the design finally selected the structural type was the one showing the lowest cost; the desired pleasing appearance was obtained by attention to proportion and to detail rather than by endeavor to create any preconceived architectural effect. Steel plate girders were chosen because they were the most efficient type for the economic span length. The design selected consists of two main girders with cantilevered floorbeams because this arrangement permits a substantial reduction in length and cost of supporting piers. Also, the two-girder system made possible a very favorable proportioning of the piers.

The bridge consists of 24 steel girder spans varying in length from 46 to 161 ft., as required to fit the topographical features and the 23 ft. adopted spacing of floorbeams. Seventeen of the spans are 115 ft. long. Span measurements were made along the slope of the girders so that all of the units were the same length. Horizontal distances between the piers were determined by the slope of the girders.



Large crane lifts second of a pair of suspended girders, while smaller crane holds floorbeam bolted to the first girder. This same program was followed in placing the 56-ton girders.



"Fish-belly" girders for the river span weighed 56 tons; they were hauled about a mile with a truck at either end. This one has just rounded the 90-deg. turn in the right background.

Streamlined piers

Piers were designed with more than usual care because they will be quite conspicuous. During most of the year they will rise as much as 55 ft. above a dry river bed. In the low water season the river occupies a channel only 300 ft. wide near the west levee, but in time of flood the level rises 40 ft. above low water stage and flows 20 ft. deep over the half-mile width between the two levees. The swift current and the heavy drift carried by floods made it inadvisable to use open column bents or towers. Streamlined piers were therefore designed, presenting a smooth and continuous surface to stream flow up to a level above flood height. Above that level each pier shaft was extended to the girder shoes in the form of two pylons. The junction between main shaft and pylons was not made at a fixed elevation on all piers but was varied to conform to a vertical curve related to the curve of the deck. In this way a pleasing balance was obtained between shaft and pylons over the whole range of pier height.

By making the concrete forms elliptical in plan, pier shaft and pylons were given streamlined noses. In

Crawler crane with 90-ft. boom and 15-ft. jib lifted concrete for paving the bridge deck that at some points was 70 ft. above ground level.

order to avoid the possibility of a harsh junction between the curved nose and a straight pier shaft, the nose curve was compounded with a transition curve extending nearly to the center of the pier. To obtain the smoothest possible surface, pier forms were faced with a $\frac{3}{16}$-in., nonabsorbent composition board, used in 4x4-ft. panels, that could be curved around a 20-in. radius.

Pleasing pier lines were obtained at minimum cost by designing to permit form simplification and the multiple use of form panels. Also, this made it possible to make the piers of cellular construction to a degree not practical with single-use forms. Though the forms were the same for all piers, the contractor actually built four sets of forms to expedite construction. As many as nine reuses were reported for some of these panels.

The piers were designed to be poured in four lifts which naturally coincided with the architectural motif. The basic dimensions of these lifts were the same for all piers except that the height was varied to suit the vertical curve. Between the lifts the faces were given setbacks to conceal the construction joint and variation in the battered faces caused by changing the height of the lifts.

Eight of the 23 piers are founded on a layer of hardpan while the remainder and the two abutments are supported on steel H-piles. The design of the foundations was based on data obtained from test holes put down by driving a 1-in. soil tube. Actual construction results later indicated that this method of foundation exploration was reliable.

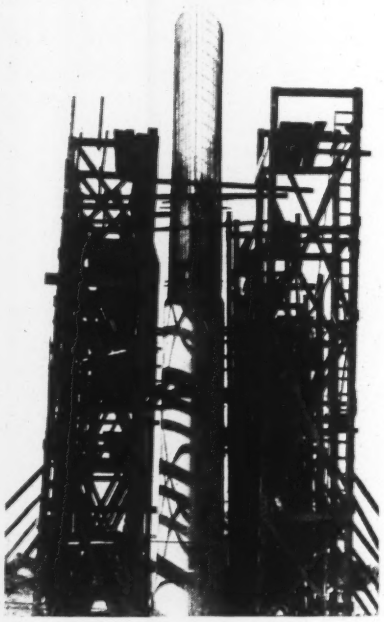
Structural features

Careful attention was given to the simplification of details so as to permit duplication of pieces and thus to facilitate fabrication in an ordinary structural shop. The 10-ft. depth of girders chosen for most of the spans was selected to permit the use of material that could be punched for riveting. Over the Western Pacific tracks where headroom was of the most importance, a 69-ft. span was used so as to permit the girders to be tapered to a depth of only 6 ft. Over the main river channel where conditions required a span 161 ft. long, it was necessary to haunch the girders to a 12-ft. 6-in. depth at the piers adjacent to this long span and to add side plates under the flange angle. These haunch or "fish belly" sections were 93 ft. long and weighed 56 tons.

Alternate spans are anchor girders with cantilevers carrying suspended girders in the adjacent spans. The suspended girder is hung on plate hangers which were made wide enough to cover the expansion gap between the sections, thus achieving visual continuity of the structural steel. The plate girders are spaced 38 ft. apart, and the connecting floorbeams are cantilevered 14 ft. The cantilever moments are transferred through the girder by means of a tension tie across the top of the girder and by milled surfaces bearing at the bottom. The deck edge and outer ends of floorbeams are covered by a plate facia girder 32 in. deep which supports the outside of the sidewalk and the structural steel railing directly above it. The railing has three horizontal rails which are continuous except where broken by lighting standards set in the railing. Luminaires suspended from these standards light the roadway.

Deck and sidewalk are of conventional reinforced concrete construction. Deck expansion joints are simple joints with rounded edges filled with expansion material. The edges of the slab are supported by the floorbeams so as to eliminate the necessity for expansion dams and armored joints.

All the steel girders, including those in the river span weighing 56 tons apiece, were set in place bodily by one crawler crane. On the heavier



Piers were streamlined, hollow shafts up to flood level, above which two pylons were used. Falsework was timber framing salvaged from ways of a wartime shipyard.

pieces a second crane was used for steadying the first girder raised until its mate was in place. These cranes worked from a contractor's road in the river bed that crossed the main channel on a fill through which large culvert pipes passed the low-stage stream flow.

The steel was delivered by rail to a siding about a mile from the job where all the yard work was done by a single crawler crane that had a 40-ton capacity. For girders whose weight exceeded 40 tons, this crane moved one end at a time. On the heaviest girders two trucks were used, one operating backward to give greatest flexibility in making turns and maneuvering generally.

The method of procedure in placing the heavy girders was for the big crawler crane to pick up the girder bodily from the trailer and raise it to position on the bridge where it could be rested on its permanent supports. Then a lighter, second crane moved up with a floorbeam, one end of which would be bolted to the main girder near the middle. This second crane then stood by steadying the girder against wind or other disturbing effects, while the second girder was lifted into place just as had been done with the first of the pair. With the second girder in place the big crane was then through and the smaller crane continued to fill in the floorbeams.

Steel placed rapidly

For temporarily carrying the outer ends of suspended spans, the contractor built six tower bents made up of piles put together in sectional units 12 ft. high. As many as five of these 12-ft. units were used for the higher portions of the bridge. A smaller number of the sections, with appropriate amount of blocking, supported the not-so-high girders. These tower bents were needed only until the final members of the span could be landed and fastened in place.

Some 4,000 tons of steel was erected in 60 calendar days and as many as six of the larger girders, ranging from 17 to 26 tons apiece, were set up in one 9-hr. day. The job called for 104,000 field rivets. One crew of four men placed as many as 700 rivets in less than 9 hr.

On the two largest girders there was considerable haste resultant from sudden indications that the river might rise and take out the fill across the main channel. Accordingly, work started on the first of the main channel girders at 1 a.m., and before noon the first of the 50-ton girders was resting on its pier supports with a floorbeam attached to the midpoint.

The race with flood water was a close one. The last heavy girder was placed by the big crane at 2 p.m., the final floorbeam at 4:30 p.m. and at 5:30 p.m. the narrow fill, on which some $100,000 worth of equipment had been working, crumbled down into rising water.

The cost of the bridge proper was $1,678,000, in addition to which the contract included 2,000 ft. of approach fills ranging up to 50 ft. in height and two grade separations, one over a city street and the other over a railroad. Thus the total bridge contract was for $1,879,000.

The bridge was designed by the bridge department, California Division of Highways, F. W. Panhorst, bridge engineer. Harry Carter was resident engineer on the substructure and C. C. Winter was resident engineer on the superstructure. Contract for construction was carried out by J. H. Pomeroy & Co., San Francisco, for whom J. N. Pomeroy was project manager. Steel was fabricated by the Consolidated Steel Corp., Los Angeles.

Sanitary Fill Operating Experiences Reveal Performance Factors

Sanitary fill disposal of refuse is well adapted for cities with available lands, located conveniently, and which will not be needed eventually for business or industrial purposes. This is one of the conclusions reached in a report of the committee on refuse collection and disposal of the American Public Works Association.

The committee pointed out that the sanitary fill should be economically attractive to a small city unable to build an incinerator, and also as a useful stop-gap measure for larger cities that have not yet completed incinerator projects. If a large city has convenient areas where the filling operation can take place, and develops skilled personnel, it may very well find that the sanitary fill is a permanent economical method of refuse disposal that meets public-health requirements.

A survey of operating experiences at a number of sanitary fill operations made by the committee indicates:

The work can be performed with a tractor equipped with a "bull-clam" shovel, a bulldozer, a dragline or a tractor scraper. Equipment of this type represents a relatively low capitalized cost investment.

Manpower requirements (including equipment operators) per 1,000 cu.yd. of refuse handled averages six men. Variations range from 3.3 to 10.6 men per 1,000 cu.yd.

Operating costs range from 40 to 50 cents per ton; this does not include cost of land or amortization of equipment. At San Francisco, where the work is handled by a private contractor, the bid price for the disposal of refuse delivered at the fill is 90 cents per ton; this probably represents a clearer picture of cost since it includes amortization and other factors, including the contractor's profit.

On the basis of population served, land requirements per 10,000 population are about 7 acre-ft.

Fills will settle 25 to 40 percent of the original height.

Rainy weather complicates the work because access to fills by collection trucks is across soft earth.

Excavations in the fill may release disagreeable odors, unless an oxidizing chemical is sprayed on the exposed surface.

Seepage from fills may cause stream pollution difficulties, and gases of decomposition may cause fire and explosion hazards if the sites are used for housing developments. (*Editor's Note:* Apropos such a situation, see *ENR* May 1, 1947, vol p. 756).

The committee that compiled the report from which the above abstract was made included: Thomas F. Murphy, supervisor of refuse collection, Chicago, Ill., chairman; Carl Schneider, consulting engineer, New Orleans, La.; Jean Vincenz, director of public works, county of San Diego, Calif.; and William S. Foster, engineering editor, *The American City*.

Traps in the pipeline on the trestle at the left permit sand to escape to form a dike below the deposit area.

Dredging a Large Sand Deposit From a Power Plant Forebay

***Contents in Brief**—An accumulation of almost a million cubic yards of volcanic sand is being removed from the forebay of an Oregon power plant by an electrically operated dredge. Dikes to retain the dredge spoil were built by mounting the discharge pipe on a trestle and allowing sand to spill out through holes or "traps" in the pipe.*

SAND, deposited in Lake Roslyn, Ore., since the Portland General Electric Co.'s Station O was placed in operation in 1912, is being removed by an electric dredge to prevent interference with the power plant operations. This work was required by the deposition of almost a million yards of sand which reduced effective storage of this power plant forebay to about one-half capacity. The usefulness of the 25,000-kva. plant for emergency peak periods was impaired because the reservoir drawdown was limited to four feet as high water velocities beyond that drawdown would carry large quantities of sharp sand particles into the water-wheels.

The accumulation of material in the lake was discovered when the reservoir was recently emptied for some repairs to the trash screens of the penstocks. Water comes into the lake largely from two small rivers, one of which flows through a deep canyon of volcanic sand. Most of the deposit consists of particles of this volcanic sand which are very abrasive as the wearing action of the streams is not enough to smooth the virgin sand.

Other remedies were considered, but the most feasible cure for the ills of this mountain lake proved to be removal of the accumulation by dredging. Locating a suitable dredge during the wartime emergency was problem enough, but transporting it from Minnesota to Oregon was even a greater problem. The 60x24x6-ft. steel hull had been constructed in two sections for train shipment, but highway loading and clearance restrictions were such that in addition each hull section had to be cut in half for transportation from the Portland, Ore., railhead to the lake.

Remove 3,000 cu. yd. a day

Under favorable operating conditions, some 3,000 cu. yd. of material can be removed in one 16-hr. work day. Actual amount of sand deposited as measured before dredging began was 840,000 cu. yd. However, the quantity to be removed may be greater than this because additional sand will be deposited during the many months required to complete

the job. Disposal area is available for an estimated million cu. yd.

The dredge has a rotating cutter mounted on a 45-ft. ladder. A centrifugal pump with a 12-in. suction discharges into a 12-in. line. The pump is driven by a 300-hp., 440-v. electric motor and power is supplied by a 2,300-v. submarine cable which is supported by floats, each made of two oil drums welded together.

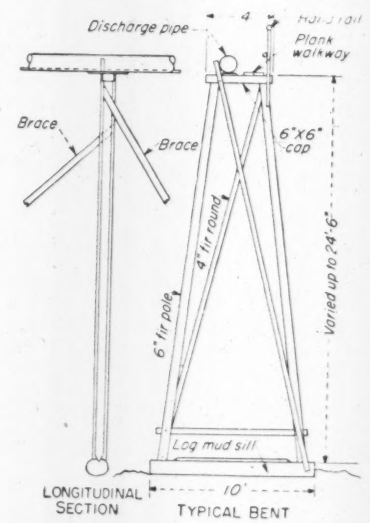
The rear of the dredge is equipped with two 18-in diameter spuds mounted 12 ft. apart which are used to pivot the dredge. By use of these spuds and swing-lines, the dredge can be walked ahead and the bite of the cutter can be controlled. A five drum hoist raises and lowers the cutting ladder and the spuds and the hoist also controls the dredge as it swings across the cut. A 60-deg. swing is used and it results in a cut some 100 ft. wide for each pass of the dredge.

This dredge, dismantled and shipped overland from Minnesota to Oregon, is removing a sand accumulation from the bottom of a lake which acts as a power plant forebay.

Spoil area above the reservoir

Dredged spoil is discharged on a ¼-sq. mi. area adjoining the lake. A site above the lake was chosen so spoil can be deposited and the excess water can drain back to the lake for power plant operation. Three sides of this area are protected by dikes in order to retain the dredged material.

To construct these dikes, a trestle was built of locally available material and the dredge discharge pipe mounted on it. Traps on the underside of the pipe were opened just enough to allow the sand for the dike to spill out. When the cutter head encountered a layer of silt, the traps were quickly closed by hand as silt was considered unsuitable for the dikes. A tractor-mounted bulldozer was used from time to time to confine the sand to proper slope.



A trestle to support the dredge pipe was constructed almost entirely from small poles readily available in the nearby woods.

A 100-ft. wood stave pipe was laid through the dike site and it is connected at the upper-end to a wooden drain structure. Side walls of this structure are kept a little above the level of the dredged fill in the spoil area so water can be drained back to the lake as the sand is deposited.

Construction of the trestle was relatively simple. However, it represents on the spot ingenuity by those responsible. The first step in construction of the bents, spaced 12-ft. apart, was to lay log mudsills 10 ft. wide. Levels were taken on these mudsills and bent heights computed. Prefabricated bents were then spotted at each of the mudsills and erected by use of a block and tackle. Some 28 bents were thus installed and the job was completed in less than 2 hrs.

Bents are made of fir poles some 6-in. in diameter with diagonal bracing of smaller fir poles. The bent cap which supports the 12-in. discharge pipe consists of a 6-in. sawed timber. A 16-in. wide walkway and handrail is provided to accommodate the men who operate the traps.

Work on this dredge operation is being done by forces of the Portland General Electric Co. A. J. Porter represented the engineering department on the planning and procurement of the dredge. V. D. Butler is foreman of operations at Station O.

Smoke Control Placed On County-Wide Basis

Taking big steps toward dispersing smoke-palls hanging over major cities, three state legislatures recently authorized smoke control agencies with countywide powers for metropolitan Los Angeles, Milwaukee, and Pittsburgh.

The American Municipal Association reports that in all three areas, the counties are now empowered to regulate air pollution without approval of the several municipalities involved.

Los Angeles County, under legislation just signed by the governor is setting up an air pollution control district with the county board of supervisors acting as governing body. An engineer-expert will be hired to administer the anti-smoke program.

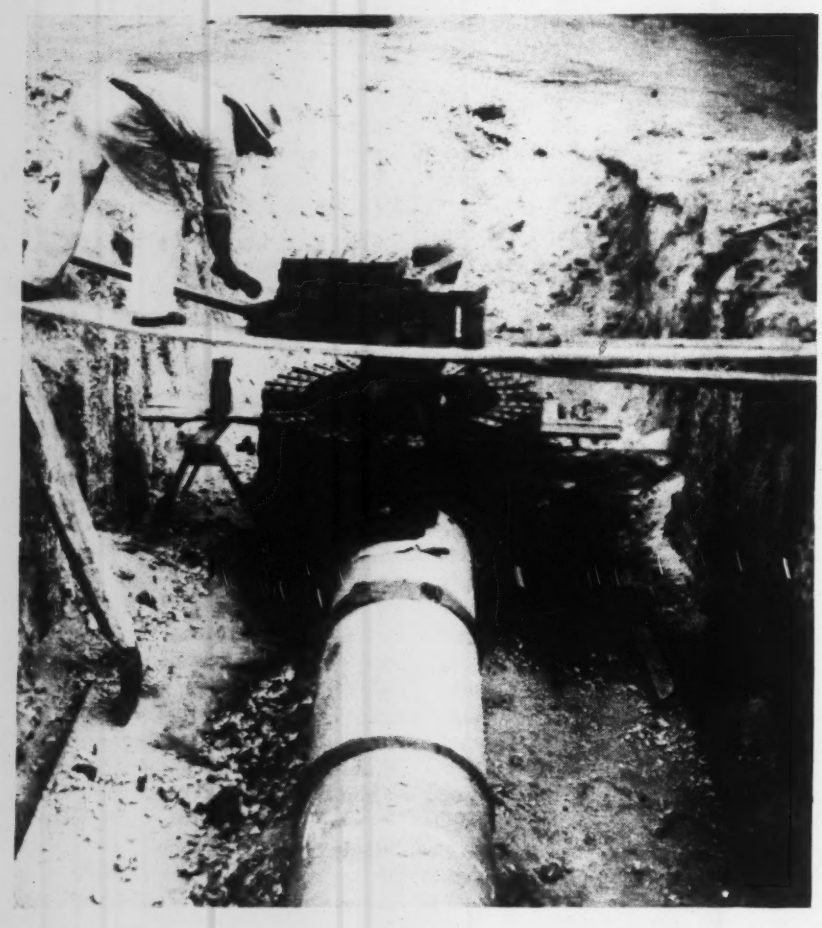
Similar state enabling legislation in Wisconsin empowers Milwaukee County to adopt and enforce a county-wide smoke control ordinance. In Pennsylvania, legislators have authorized Allegheny County (Pittsburgh) to pass the same kind of ordinance.

Special Facilities Drain Florida Highway

***Contents in Brief**—Drainage for a portion of a dual-lane highway now under construction north of Miami, Fla., consists of gutter inlets with pipe connections to large sumps located under the median strip. Spaced about 500 ft. apart, the sumps have a precast concrete top but the sidewalls and bottom are the undisturbed porous rock which absorbs the runoff quickly. For another portion of the road, the gutter inlets connect to large underdrains below the median strip in porous sand.*

A DIFFICULT drainage problem in building a multiple-lane highway on State Route 9 at the north edge of Miami, Fla., was overcome by the use of large sumps located in porous rock for one section of the project and long special pipe underdrains for another section. If these facilities had not been used, more expensive construction, including the use of automatic pumps, would have been required to carry the runoff to distant streams.

The project has a total length of 5.2 miles. For about three miles, two 30-ft. 6-in. roadways separated by a 14-ft. grassed median strip are provided. Along each side of this strip, 8-in. high curbs are used, and at the outside edge of each roadway an 18-in. wide gutter and a 6-in. high curb are provided. Each pavement is sloped away from the median strip on a parabolic crown. The remaining length of the project is much the same type of construction except that the roadways are only 24 ft. wide to provide for two lanes of traffic in each direction.



For one section of the project the runoff from the roadways is carried to manholes over large sumps constructed in porous limerock. The top of the sump is a precast slab, on which the pipe in the foreground is laid.

The road traverses nearly flat country. For half of the project the typical foundation condition is sandy topsoil of varying thickness overlying porous limerock (Miami oolite). Near the north end of the project a section having several feet of unstable soil overlying stable material made waste and backfill necessary.

Because of the nearly flat terrain, its slight elevation above sea-level, and the distance to positive draining open streams, it was desirable to take advantage of the porous character of the underlying rock and sand in providing drainage for part of the job.

For about one mile of the highway the runoff from the roadway is collected by catchbasins along the outer edge of the pavements and is then carried to large sumps located below the highway in the porous limerock. These sumps are spaced about 500 ft. apart along the centerline of the median strip. Each sump is of 16-ft. minimum length, 4 ft. wide and 4 ft. 6 in. deep. The sidewalls and bottom are the natural porous rock, while the top is a reinforced concrete slab precast in three sections.

Rapid disposal is expected

The typical sump is located at sufficient depth that the top is covered with about 6 ft. of soil. Location of the sumps at this depth is expected to permit disposal of the water from the sump into the surrounding limerock. Tests with one of the first sumps built indicated that the flow through the walls and bottom would be about 800 gpm. with the level of the water in the sump 4 ft. above the water table.

The catchbasins at the outer edge

The trenches for the pipes connecting the catchbasins and the underground sumps and drains are prepared with a trenching machine. A 15-in. pipe with sealed joints connects the basins to a manhole on top of the sump.

of each pavement are spaced to remove gutter flow at 300 to 500 ft. intervals. The basins are directly connected by 15-in. pipe with sealed joints to a 3-ft. dia. manhole built on the precast top of the sump (Fig. 1). In a few cases the flow from two or three of the catchbasins is transported by 15-in. pipe to a 4-ft. dia. manhole located in the median strip, from which point the combined flow is carried to the manhole over the sump through an 18-in. dia. pipe. This procedure is used only when cross streets or other conditions make necessary the use of extra catchbasins or an odd spacing of the basins.

In constructing the sumps the required excavation was accomplished with a small crawler shovel, care being exercised to keep the sidewalls vertical in the soft rock.

The center section of the precast top for the sump, which is the section on which the manhole was built, is 10 in. thick, 6 ft. 8 in. long and 8 ft. wide, which results in 2 ft. of bearing at either side. Each of the end sections of the top was made 8 in. thick, and of the same length and width as the middle section. In casting the sections, which was done at a central yard, exposed steel loops were provided at each corner of the slabs to permit them to be handled readily by a crane.

In building the manhole located on top of the slab of the sump, the walls were made 8 in. thick and they were plastered on the outside with sand-cement mortar. Near the bottom of the manhole a steel grating with 1x4-in. openings is provided to prevent coarse material from entering the sump. The hole in the precast slab directly beneath the manhole is 3 ft. in diameter.

Pipe drains for one section

For another section of the highway the top of the porous limerock is below the water table. In view of this condition, it was considered unsatisfactory to use sumps of the type just described. Instead the water is collected by catchbasins located at the outer edge of the pavement and then is carried to pipe underdrains located along the center line of the median strip which act as sumps.

Each of these consists of about 100 ft. of open-joint precast concrete pipe of 18-in. diameter surrounded by graded crushed stone. This pipe is located on the center line of the median strip and the top of the pipe is about 6 ft. below the grassed surface of the dividing island.

The natural ground material surrounding the drains is sandy, highly porous top soil so common to the area. In all, 13 of the pipe drains are being used with their combined length totalling 1,600 ft. The spacing of these drains along the median strip is about 500 ft.

For the remainder of the highway the terrain is such that adequate drainage is provided by allowing the runoff from the roadways to travel across the grassed shoulders to open gutters. The shoulders for this section are 8 ft. wide and are sloped away from the pavement on a slope of $\frac{3}{4}$ in. per ft. No curb and gutter are used at this location.

The project, which is scheduled for completion early in 1948, is being constructed by the Florida State Road Department. For this organization E. C. De Garmo is chief engineer and engineer of construction. Scott Reynolds, drainage engineer, J. M. Watson, division engineer, and F. E. Cullum, project engineer. The contract for the grading, paving and drainage, totals $837,000. It is held by R. H. Wright and Son, Inc., Fort Lauderdale, Fla. For this firm C. G. Trundle is serving as general superintendent.

For the Public Roads Administration, which is aiding in the financing of the project, B. P. McWhorter is division engineer at Atlanta, R. B. Smith district engineer at Tallahassee, and Wm. N. Ryerson supervising construction in Florida.

Collapsible Pile-Driving Rig Facilitates Moves from Job to Job

A FOLDUP, drive-way pile driver which can be moved from job to job in a matter of hours, or do one job in the morning and another in the afternoon, has been designed and constructed by the Wainer Construction Co, of Valdosta, Ga. The long hours of dismantling and erecting and moving equipment from one job to another or having equipment tied up while waiting for transportation or other delays, all have been eliminated by this new type of pile driver.

The hauling unit consists of a long-wheelbase truck and a tandem-wheeled trailer as part of the outfit. The hoist is mounted on the truck, which also carries a 18-ft. boom used to load and unload the pile driver, and for setting up and taking down the pile leads. The truck is also used to carry the operating hoist used to operate the driver.

Truck with all the equipment is driven on a prepared platform on the end of the pile driver where it is fastened down to the machine by cables. The hammer lines are attached to the hoist for operating the machine.

The leads are collapsed by lowering from an "A" frame which is set up on the hoist truck. The truck is first driven off the rig, the "A" frame is set up on the back end, and the leads are lowered by the "A" frame with the power hoist. Leads are 60 ft. high and can handle 50 ft. piles. The "[illegible] wales" are 60 ft. long. Power is [illegible]plied to a double-drum hoist [illegible] a 50-hp. engine. Up to a 3,100-lb. h[illegible]mer can be used on this rig.

The pile driver is moved from [illegible] to pile by cables attached to ho[illegible], which in turn are attached to [illegible] 4x8-in. hickory timbers on which [illegible] rig slides; the weight of the ou[illegible] holds these timbers in place. Th[illegible] are no rollers involved.

Main advantage is the ability to fold this rig and move it with ease over the highways. It is so designed that it meets state highway requirements as to width.

When set up for driving, the truck is driven onto a platform at the rear of the frame to provide the weight needed to stabilize the rig.

Waste Treatment Plants Put Under Construction

Under orders of Pennsylvania's State Sanitary Water Board, a waste treatment system is being built at Pennzoil's Oil Creek refinery at Rouseville, Venango County. When in operation, this project will serve to abate pollution in Oil Creek, a tributary of the Allegheny River.

The plant will include two separators with a combined capacity of about 43,000 gal. to remove oil and settleable materials from the refinery wastes. These devices will provide not only increased capacity but also greater efficiency of operation.

The separators are designed to handle the most intensive runoff expected from rainfall records in that area, and thus prevent polluting overflow. To reduce the amount of water taken for operation of the refinery, treated water will be reused.

Included in the project are relocation of some of the refinery tanks, new pipelines from the refinery area to the treatment units, and construction of dikes around the tanks and along the banks of the creek to provide flood protection.

Another waste treatment system, also under construction as the result of orders issued by the Sanitary Water Board, is that at Prest-O-Lite Company's plant at Pittsburgh. This job includes two sedimentation basins with a total storage capacity of about 2,000,000 cu. ft. Separation of solid materials from water used in the manufacture of gas will reduce pollution in Chartiers Creek on which the plant is located.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Fundamental Right Violated

Sir: There appeared in your Oct 23 issue, vol. p. 557, the news that the chief highway commissioner of South Carolina had forbidden department employees to accept "off-hours" employment. This is a serious invasion of a fundamental right of the employees of this state agency which I trust will not pass unchallenged. I refer to the right of any employee to use his own time as he sees fit.

Ambitious energetic persons have always devoted a part of their spare time to gainful purposes, whether it be to directly increase their income by working, or in less immediately productive efforts such as studying or establishing contacts.

The two possible arguments against gainful employment during spare time are:

1. It can, if overdone, impair the efficiency of the employee at his regular work.
2. Being assured of a steady income from regular employment, he can unfairly underbid others in his part-time work.

The first point is unquestionably a matter of concern for the commissioner. However, all civil-service systems provide methods for discipline or removal of employees whose work is below par, and this is the only fair approach to the problem. Many persons perform at a high level though working during spare time and they should not be arbitrarily restricted.

The second point, while equally serious, is of general professional interest and isolated action by a single employer will have small effect.

The late Mayor La Guardia of New York City made this same error about the year 1940. His right to so restrict municipal employees was challenged in the courts and he was not sustained. However the average employee refrains from taking legal action because of the cost and out of a fear of reprisals. It therefore behooves the rest of us to exercise ourselves in his behalf.

I should be glad to hear what others have to say in this matter in the hope that the attending publicity may move the commissioner to reconsider.

NOMER GRAY
Westwood, N. J.

Representation for Engineers

Sir: The editorial in your Oct. 2 issue entitled, "Face The Facts," discusses a problem of the engineering profession that requires solution. The views expressed therein are entitled to serious consideration because they are based on experience and are a constructive analysis of the situation. Even so, for those who have been working for years toward a unified engineering profession entitled to a "place in the sun" on a par with the other learned profession it is dismaying to find the recommended solution a continuation of the present overlapping that besets us.

I believe that all will agree with your last sentence that there should be no conflict between the National Society of Professional Engineers and the Founder Societies. Each has an important function to perform and the two should be complementary. The basic disagreement, however, lies in the timing. Your thesis appears to be that NSPE is not ready to take over the professional, economic, and social representation of the profession on a national scale because it is not yet strong enough, and that the Engineers Joint Council should be strengthened to fulfill this duty. The difficulty is that you are asking the professional engineer to lend his support to two distinct organizations, performing essentially the same functions. Eventually the profession must decide on the vehicle to be used—why not now? There is no reason to presume that NSPE has set for itself an "impossible task".

What is the alternative to a national society representing all branches of the profession insofar as the economic, social, and cultural aspects are concerned? The alternative your editorial favors is the EJC, which has done noble work. Experience has shown, unfortunately, that an organization which depends upon sponsoring organizations and which cannot act until all of the sponsoring organizations are unanimous, cannot do the job on a long term basis and cannot be effective at crucial moments. Such an arrangement is but a further splintering of the profession with the added handicap of inter-society differences. Who will speak for the profession if the sponsors of EJC cannot agree? Unanimity would be a good thing for the profession, but if it cannot always be obtained are we to be impotent like the UN when one veto is exercised?

One is led to the conclusion that the profession must have one national organization, based on democratic principles, and devoted solely to the promotion and protection of ALL professional engineers. Those whose views are in accord with the tenor of your editorial can be of most service to the profession by supporting the development of a strong unified national organization. NSPE is young, but it does provide the type of vehicle which can be enlarged and supported to occupy a place in the engineering profession equivalent to the other major professional societies. This can be done in a relatively short time if the Founder Societies and other professional engineering groups make it a matter of common cause for the benefit of all.

H. E. BABBITT
Professor of Sanitary Engineering
University of Illinois, Urbana

Parking Costs At Airports

Sir: Your article in the September 18 issue, p. 103, entitled "Many Cities Open Off-Street Parking Lots" states that "Rates vary from ten cents per day in Akron to thirty-five cents for twenty-four hours in Chicago."

This really does not give the complete story. The city of Chicago charges twenty-five cents for each four hours of parking at the Municipal Airport parking lot, making the rate $1.50 per 24 hr. for those airline passengers who are away that long. Incidentally, I understand that the airline employees have to pay the same rate or park in side streets.

L. F. DOBRY,
Berwyn, Ill.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

How Materials Behave

TEXTBOOK OF THE MATERIALS OF ENGINEERING. Seventh Edition, by Herbert F. Moore. 500 pp. McGraw-Hill Book Co., New York 18 and London. $5.

To make room in this new edition for mention of the newer materials of construction and additional data on processing of metals, the author has decreased the amount of detailed description of manufacturing processes. Tables give properties of a relatively few typical structural metals rather than a complete tabulation, and discussion is confined quite closely to stress-carrying materials. The edition has also been enlarged by a chapter on plastics and a list of films that may be used to supplement the subjects in the book.

Out-of-Date Railroading

ELEMENTS OF RAILROAD ENGINEERING—Sixth Edition. By the late William G. Raymond, Henry E. Riggs and Walter C. Sadler. 442 pp. John Wiley & Sons, New York; Chapman & Hall, London. $5.

Inclusion of new information on streamlined trains and diesel locomotives does not conceal the fact that most of the content of this once famous text on railroad engineering is now so out of date as to be little value, and much of it is misleading because its antiquity is not evident to the uninitiated. For example, the tables of distribution of freight by classes of carriers, river tonnage by commodities and sources of highway income are the same tables that were in the fifth edition, published ten years ago. The highway income table then was already eight years old.

The chapters on rail, track and structures are practically unchanged since the 1937 edition and they were getting old then. Most of the drawings in these chapters are the same that were used in the first edition in 1908. Thus, culverts and bridges that are shown as New York Central standards actually are the standards of 40 years ago.

Wood-box culverts are described in detail, although they are never built today, but there is no mention of corrugated metal culverts now so widely used.

In the chapter on estimating, the cost figures are identical with those given in the 1937 edition, yet there is nothing in the text to indicate that they are not based on current prices of labor and materials.

Controlling Indoor Weather

AIR CONDITIONING. By Herbert and Harold Herkimer. 692 pp. Chemical Publishing Co., Brooklyn, N. Y. $12.

Data accumulated during 35 years experience in the air-conditioning industry is presented in this book. The first part deals with pertinent chemistry, physics and thermodynamics, and the second part with application aspects, such as equipment and costs. Included are chapters on heat transmission of building materials, air distribution, humidification control, spray systems, cooling towers, refrigeration, unit and central air-conditioning systems, automatic controls, cost estimation and practical applications. Clearly and concisely written, the book should be useful as a text or handbook to the engineers engaged in design and installation.

Miscellaneous Notes on Booklets and Reprints

CALIFORNIA CIVIL ENGINEER REGISTRATION EXAMINATIONS and Their Solutions—by A. E. Waegmann. 170 pp. (mimeographed). Available from the author at 2833 Webster St., San Francisco 23, Calif. $3.50.

"PERFORMANCE STANDARDS", containing structural and insulation requirements for houses, has been published by the Technical Office of the Housing and Home Finance Agency, Washington 25, D.C., to provide a uniform basis for measuring the adequacy of building materials and home construction methods. Applying to dwellings up to 2½ stories high, the document requires that physical properties of floors, walls and roofs conform to nationally recognized standards, or in the absence of such, that they shall be determined by appropriate tests.

RECONSTRUCTION OF THE PORTS in France is covered in considerable detail in the April, 1947 issue of *Travaux*, French magazine published by Science et Industrie, 6 Ave. Pierre Premier de Serbie, Paris (16e). Articles are devoted to a total of 14 different ports. The price of this particular issue is 250 fr. ($2.10).

PROFESSIONAL EMPLOYEES interested in the Taft-Hartley Act (Labor Management Relations Act of 1947) will find valuable information in a pamphlet entitled "What the Taft-Hartley Act Means to the Professional Employee," published by the New York State Society of Professional Engineers, 1941 Grand Central Terminal, New York 17. Price 10c.

New Engineering Books

TEXTBOOK OF THE MATERIALS OF ENGINEERING—7th Edition—By H. F. Moore. 500 pp. McGraw-Hill Book Co., New York 18 and London. $5.

ARCHITECTURAL CONSTRUCTION — THE CHOICE OF STRUCTURAL DESIGN—By T. Crane. 414 pp. John Wiley & Sons, New York. Chapman & Hall, London. $6.

YALE SCIENCE—THE FIRST HUNDRED YEARS 1701-1801—By L. W. McKeehan. 82 pp. Henry Schuman, 20 East 70th St., New York 21. $2.50.

SOIL MECHANICS—ITS PRINCIPLES AND STRUCTURAL APPLICATIONS—Second Edition. By D. P. Krynine. 511 pp. McGraw-Hill Book Co., New York 18 and London. $5.50.

PROCEEDINGS OF THE TWENTY-SIXTH ANNUAL MEETING — Highway Research Board, 1201 Constitution Ave., Washington, D. C.

DECAY OF TIMBER AND ITS PREVENTION—By K. Cartwright and W. Findlay. 294 pp. His Majesty's Stationery Office, Kingsway, W. C. 2, London. 12/6d.

ELEMENTS OF RAILROAD ENGINEERING — Sixth Edition—By the late W. G. Raymond, H. E. Riggs and W. C. Sadler. 442 pp. John Wiley & Sons, New York. Chapman & Hall, London. $5.

(*Continued on p.* 180)

FROM START TO FINISH . . . .

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New York Pittsburgh San Francisco Seattle Tulsa

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents
January Materials and Labor Prices will appear in the January 8, 1948 issue.
Mexico City, Mexico prices are published in this section of Engineering News-Record each month.

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT* Per bbl. C. L. lots incl. $1.00 per bbl. for bags, cash dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		CONCRETE Ready Mixed 1:2:4, over 6 sack per cu. yd.
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt.Agg.	5.0 c.y. job
Atlanta	$3.87	$4.07	$2.82	....	....	$1.75	$2.10	$2.10	$1.65	$1.85	$0.1725	....	$10.05
Baltimore	3.71	2.91	2.66	$2.10*ft*	$2.10*ft*	1.60*ft*	2.25*ft*	2.35*ft*	2.20*ft*	2.20*ft*	.145	$0.145*w*	8.55
Birmingham	3.55	2.75	2.45	2.06	2.06	1.63	2.50	2.50	1.00	1.20	.15	.15	6.95
Boston	4.13	3.33	3.08	1.50*tt*	1.50*tt*	1.40*tt*	1.25*tt*	1.35*tt*	....	....	.186	.195*w*	9.43*q*
Chicago	3.65	2.85	2.60	2.60‡*d*	2.60‡*d*	2.85‡*d*	2.60‡*d*	2.60‡*d*	2.00‡	2.00‡	.20	.20*x*	....
Cincinnati	3.69	2.89	2.64	1.70‡*bb*	1.70‡*bb*	1.60‡*bb*	2.75‡*bb*	2.75‡*bb*	....	....	.17	.195	9.06*kk*
Cleveland	3.64	2.84	2.54	1.90*llz*	1.65*llz*	1.25*ll*	3.20‡*h*	3.20‡*h*	2.45	2.45	....	.20	10.40*ii*
Dallas	3.57	2.72	2.47	1.80	1.80	1.60	1.89	1.99	....	....	.0775*p*	....	8.08
Denver	4.03	3.23	2.98	1.85	2.00	1.15	....	....	....	....	.2245	.2245*w*	9.25
Detroit	3.54	2.74	2.49	3.00‡	3.00‡	2.75‡	2.75‡	2.75‡	2.75‡	2.75‡	.17*w*	.18*w*	8.30*kk*
Kansas City	3.68	2.88	2.63	1.85	1.85	1.40*t*	1.45*q*	1.45*q*	....	....	.16*wf*	.175*ay*	9.50*s*
Los Angeles	3.90*eeh*	3.40*h*	2.05*h*	1.87*t*	1.87*t*	1.67*tnu*	1.87*t*	1.95*t*	....	....	.080*o*	....	9.30*m*
Minneapolis	3.85*dd*	3.05*dd*	2.80*dd*	2.00*h*‡*j*	2.00*h*‡*j*	1.10*h*‡*j*	2.10*h*‡*j*	2.10*h*‡*j*	....	....	.19*cco*	....	10.05*kk*
Montreal	....	2.17*r*	2.02*r*	1.78*hhs*	1.78*hhs*	1.10*s*	.95*cs*	1.05*cs*	....	....	.1391	.1515*w*	7.75*ks*
New Orleans	3.43	2.58	2.33	1.82	1.82	1.62	....	....	.90	1.15	...	....	9.92
New York	4.75‡	3.75‡	....	1.85*de*	1.85*de*	1.30*de*	2.00*de*	2.00*de*	....	....	.16/.18*ii*	.16/.18*wccii*	9.90*k*
Philadelphia	3.52‡	2.72‡	2.47‡	2.20‡	2.30‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.20/.22	.20/.22*w*	9.25
Pittsburgh	3.51	2.66	2.41	1.90‡	1.90‡	2.20‡	2.35‡	2.35‡	1.90	1.90	.22*z*	.22*z*	10.85
St. Louis	3.66*o*	2.86*o*	2.61*o*	2.25‡*oh*	2.25‡*oh*	2.00/2.25‡*oh*	1.35*c*	1.35*c*	....	....	.195	.22*yo*	10.15
San Francisco	....	3.04	2.64	1.71	1.71	1.81	1.81	....	....	....	....	.25*y*	9.80*s*
Seattle	....	3.20*mm*	2.80*mm*	2.50‡*od*	2.50‡*od*	2.50‡*o1*	3.00‡*od*	3.00‡*od*	....	....	.18*o*	....	9.00*s*

‡ Delivered. *a* F.o.b. truck at plant. *b* 20c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* F.o.b. truck on job. *g* Pea gravel. *h* Truck Lots. *i* ½ in. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* F.o.b. car or truck at plant. *r* 10¢ per bbl. off cash 20 days. *s* 8% sales tax included. *t* Truck delivery. *u* 10 to 100 c.y. brackets. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Aver. haul, 7-9 mi. zone. *bb* 5 tons or more. *cc* Also 8 x 8 x 18 in. *dd* Dealers sell only in LCL. This is price for CL and does not include dealer's commission. *ee* 20c refund for each returnable bag. *ff* LCL. *gg* 10c. refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 30¢ refund for each returnable bag. *ll* Price at plant, called for. *mm* 10¢ per bbl. off cash 10 days. *nn* Concrete Sand .00 4x8x12 std. wgt. * Prices include dealer's commission except where indicated to the contrary.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.05 per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 25c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$2.10	$2.10	Ironton, Ohio	$2.05*	$2.05*	Universal, Pa.	$2.10	$2.10
Hannibal, Mo.	2.10	2.10	Northampton, Pa.	2.00	2.00	Waco, Tex. (Plus 9c. tax in Tex.)	1.95	1.95
Independence, Kans.	2.10	2.10	Richard City, Tenn.	2.10	2.10	Montreal City (Discount 10c. per bbl. 20 days)	1.88	1.88
			Steelton, Minn.	2.20	2.20			

* Destination price base effective Aug. 14, 1947

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	PAVING ASPHALT Per ton, less than 80 penetration Tank car	Drums	ASPHALT BINDERS—FLUXES Per gal., 80-300 penetration Tank car	Drums	CUTBACK ASPHALT Per ton Tank car	Drums	ROAD OIL Per gal. Tank car	ASPHALT EMULSION (Quick-breaking) Per gal. Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	....	$0.074	....	$0.0806*h*	....	$0.0781	$0.0806	....
Baltimore	150.00‡	52.70‡	.....	15.00	$21.00	.0775	$0.1075	13.00	$23.00	.10	.075†	$0.11
Birmingham	....	32.00	....	....	....	....	....	....	....	....	....	....
Boston	85.00	59.00	3.75	17.00*o*	29.50*o*	.0723*o*	.1447*o*	.075*ho*	.145*ho*	.07*o*	.0907*o*	.18*o*
Chicago	150.00‡*y*	75.00/80.00*ee*‡	2.97/4.10‡	19.00/20.00*b*	29.00/29.50*b*	17.50*bg**	26.50/27.00*bg*	.085/.0875*bh*	.17/.1725*bh*	.0725/.075*b*	.0925/.1025*b*	.14/.165*b*
Cincinnati	....	....	....	19.40*z*	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	186.52	47.00*t*	3.77	24.50	36.00	24.50*g*	36.00*g*	.105*h*	.24*h*	.11	.135	.24
Dallas	*l*	40.00	*l*	16.95	29.15	.0686	.1225	20.00	37.60	.05	.0675	....
Denver	.....	38.00	.....	.....	.....	.....	.....	23.50	.....	20.00*j*	.....	.....
Detroit	.....	63.00*x*	.....	20.00	26.00	18.40*g*	24.40*g*	.0811*h*	.128*h*	.075	.1085	.1522
Kansas City	.....	40.00	.....	17.60	.....	16.00*g*	.....	.075*h*	.....	.0675	.09	.....
Los Angeles	*l*	.....	*l*	12.50*f*	.....	.....	.....	13.00*h*	.....	.04*h*	.10*h*	.20*h*
Minneapolis	.....	.....	2.39*d*	23.00	32.00	17.00*g*	28.00*g*	23.00	33.00	.08	.09	.15
Montreal	100.00	.....	.....	16.60*k*	24.25*k*	11.60*kp*	14.85*kp*	11.50*kp*	13.50*kp*	.08*kj*	.135*k*	.188*k*
New Orleans	.....	.....	.....	15.50*a*	....*s*	13.50*ga*	.....*s*	6.75*a*	.....*s*	.055	.08	.13*n*
New York	.....	.....	2.25*d*	20.95	31.35	19.95*g*	37.79*g*	.0868*h*	.1632*h*	.0818	.0866	.1608
Philadelphia	150.00	62.00	4.06	19.00	.....	17.00*g*	.....	.08*h*	.....	.....	.....	.....
Pittsburgh	142.00	42.00	3.90	20.00	31.00	.10	.20	22.00	35.00	.08	.09	.18
St. Louis	.....	43.50	.....	16.50	17.00	22.50	23.00	15.50	16.00*j*	21.50	22.00*g*	.075/.08*h*	.165/.17*h*	.065/.07	.075/.095	.125/.15*
San Francisco	.....	54.00*e*	.....	14.50	31.75*e*	14.50*g*	.....	15.00	.....	.....	.0575	.1275
Seattle	.....	.....	.....	14.50*i*	31.00*i*	13.00*ig*	.....	15.00*i*	19.00*kai*	14.00*ig*	.0625*i*	.072*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2½ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* 40-300 penetration. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* Shipped in drums. *k* Tax included. *l* Not used. *n* 55 gal. drums. *o* Price at plant. *p* Per 100 gal. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *w* Shipped in double head wood barrels. *x* Truck deliveries in Detroit $75.00. *y* Carload lots. *z* 50-300 penetration. *aa* In customer's drums. * Price ranges from $17.50 to $18.00. † Correction: Unchanged from Nov. price.

IRON AND STEEL PRODUCTS — BASE MILL PRICES

	STRUCT. SHAPES PLATE[f]	REINF. BARS billet[b,e,f]	RIVETS ½-in. structural[f]	WIRE NAILS Base[f]	SHEET PILING Base[f]	STEEL RAILS Per Net Ton Standard[i]	Light	Relaid[i]	TRACK SUPPLIES Angle Bars	Spikes[e]	Tie Plates	Track Bolts
Birmingham	$2.80	$2.75	$5.65	$4.25/5.00	...	$55.00	$62.00	Not	$3.25	$4.85	$3.05	$7.00
Chicago	2.80	2.75	5.65	4.25/5.00	$3.30	...	...	avail-	3.25	4.85	3.05	7.00
Pittsburgh	2.80	2.75	5.65	4.35/5.00	3.30	55.00	62.00	able	3.25	4.85	3.05	7.00
Buffalo	2.80	2.75	....	....	3.30	.....	.....	....	....	....	3.05	....
Cleveland	....	2.75	5.65	4.35/5.00	....	.....	.....	....	....	....	....	....
Youngstown	....	2.75	....	....	....	.....	.....	....	....	4.85	....	....
Detroit	....	....	....	....	....	.....	.....	....	....	....	....	....
Gulf ports	....	....	....	....	....	.....	.....	....	....	....	....	....
Geneva	2.975‡	....	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	3.41/3.47‡	3.325‡	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *b* Rail steel price upon application. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports. On tie plates alone Steelton, Pa.; on spikes alone Lebanon, Pa., Richmond, Va. *f* A41 switching charge $18 per CL. *i* Mill lengths. Add 50¢ for cut lengths. *l* Per 100 lbs.

IRON AND STEEL PRODUCTS — F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS[j] Per 100 lb., base price *u* 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$ cwt. for Del	EXPANDED METAL LATH[k] Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed, 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x4 in., No. 5 & 10 wires	4x4 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires	SHEET PILING Per 100 lb. base price
Atlanta	$5.02‡	$5.12‡	$5.12‡	$.025	$.10	$31.00	$33.00				
Baltimore	4.68	3.96*t*	....	....	.10	33.50	35.50	$2.40	$1.66	$2.52	$4.25
Birmingham	4.10	4.25	4.25	.05	.10	37.50*p*	40.50*p*	....	....	....	....
Boston	4.92‡	4.65‡	4.096*x*	....	.10/.15	29.00	31.00	2.48	1.71	2.60	3.753*k*
Chicago	4.40	3.65*ff*	3.65*ff*	.05	.05	27.00‡	29.00‡	....	....	....	3.30*t*
Cincinnati	4.79‡	3.819*e*	3.819*e*	....	....	29.00*eee*,*y*	31.00*eee*,*y*	....	....	....	3.644
Cleveland	4.65	3.54*tc*	....	....	.10	29.00	31.00	....	....	....	....
Dallas	6.72	5.50‡	5.50‡	....	....	29.15	31.35	....	....	....	....
Denver	5.28	5.80*e*	....	....	....	40.00*e*	45.50*gx*	....	....	....	5.70
Detroit	4.77‡	4.73‡	4.73‡	....	.10	33.00*z*	35.00*z*	....	....	....	3.6512*z*,*l**
Kansas City	5.15*ee*	4.31‡*rik*	4.31‡*rik*	....	.10	34.00	36.00	....	....	....	3.788
Los Angeles	5.30*f*	4.43	....	....	....	30.50	32.50	....	....	....	....
Minneapolis	4.78‡	4.984*ccn*,*t*	4.984*ccn*,*t*	....	.15	29.50*h*	31.50*h*	....	....	....	3.817*k*
Montreal	4.55*i*	4.20*i*	4.20*i*	....	....	36.00*h*	38.70*h*	....	....	....	73.00*yd*
New Orleans	....	4.64*ok*	....	.05	.10	27.50	29.50	....	....	....	.....
New York	4.52*r*	4.50	....	....	.15/.20	30.00*at*	32.00*at*	2.44	1.68	2.56	3.35*s*
Philadelphia	4.52	4.59‡	....	....	....	30.00‡	32.00‡	2.41	1.67	2.53	3.43‡
Pittsburgh	4.40	4.55‡	4.55‡	.05	.10	26.00	29.80	2.24	1.56	2.35	5.05
St. Louis	4.699‡	3.87*ct*	3.87*ct*	....	.05	38.00‡	40.00‡	....	....	....	....
San Francisco	5.10	4.53‡	....	....	....	32.50	34.50	....	....	....	4.85
Seattle	5.628*e*	4.58‡*e*	....	....	....	43.00*e*	46.00*e*	....	....	....	4.355*dd*

‡ Delivered. *a* Mill prices. *b* 5 tons, add 35¢. Less than 1 ton, add 50¢. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. plant. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15¢ differences between new billet and rail steel. *h* List price. Dominion tax exempt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Del. of 5000 sq. yd. or less. *q* Std. ribbed 4 lb. per sq. yd. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1¼ in., 1½ in. 10¢; ¾ in., ⅞ in. 15¢; ⅝ in. 20¢; ½ in. 35¢; ⅜ in. 55¢; ¼ in. $1.30. *x* Under 20 tons. Straight. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* $.0093 transportation tax included. *z* Copper alloy. *aa* 20 tons base. *cc* F.o.b. cars Chic. plus freight. *dd* F.o.b. dock. *ee* F.o.b. cars. *ff* Carload lots. *gg* Unchanged since Sept. comparable Aug. std. diamond mesh price was $26; std. ribbed, $28. *k* Price includes quantity charge and size charge of 15¢ per cwt. for ¾". * Correction: Nov. price was $3.6512.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13-44T std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM C4-24 Per 1,000 ft., carload lots, f.o.b. 6 in	8 in	CONCRETE SEWER PIPE Per ft., delivered; ASTM C 14-41 12 in	24 in	WROUGHT STEEL PIPE** (Full standard weight, f.o.b. destination *s*) 2½ & 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
Atlanta	$79.78	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00	50.7	36.2	46.7	31.7
Baltimore	84.10	378	720	3.105	8.098	147.00	228.00‡	.80	2.20	54.4	39.9	50.4	35.4
Birmingham	74.50	375	.675	3.06	....	210.00‡	375.00‡	.75	2.00	50.7	36.2	46.7	31.7
Boston	88.70	.392*uu*,*v*	.756*uu*,*v*	3.465*uu*,*y*	8.7125*uu*,*y*	150.60	233.40	1.03*pp*	2.75*pp*	52.7	38.2	48.7	33.7
Chicago	85.06	54	1.04	4.12	12.80	150.00‡	270.00‡	.65	2.25	56.5*t*	42.0*t*	51.5*t*	36.5
Cincinnati	83.86	406	.783	4.00	12.00	155.00‡	240.00‡	.60	2.25	54.9	40.4	50.9	35.9*t*
Cleveland	85.54	.329*r*	.6345*r*	2.79*r*	7.38*r*	135.50	212.00	.58	2.25	57.15	42.65	53.15	38.15
Dallas	87.28	375	.675	2.70	6.20	109.00	131.00	.45	1.45	48.8	34.3	44.8	29.8
Denver	92.12	.38*dd*	.68*dd*	2.84*dd*	....	.....	.....	.64*dd*	2.25*dd*	46.9	32.4	42.7	27.7
Detroit	85.54	.51	.98	4.31	10.79	170.00‡*m*	260.00‡*m*	.50	1.90*t*	55.4	40.9	51.4	36.4
Kansas City	86.62	.39*m*	.705*m*	2.78*m*	6.85*m*	175.00*m*	310.00*m*	.50*t*	1.70*t*	52.2	37.7	47.8	32.8
Los Angeles	98.50	.414‡	.894‡	4.347	10.868	.....	.....	.65	....	....	....	....	....
Minneapolis	90.00	.51*mo*	.98*mo*	3.95*mo*	....	.....	.....	1.05*h*	2.90*h*	52.3	37.8	47.9	32.9
Montreal	78.20	.68*s*	1.20*s*	3.94*s*	6.38*ss*	.48*pss*	.68*pss*	72.00*jkss*	218.00*jkss*	....	....	....	....
New Orleans	82.18	.40	.72	3.06	....	220.00*bb*	.....	.55	1.95	50.3	35.8	46.3	31.3
New York	83.30	.59	1.09	4.24	10.79	.....	.....	1.00	2.25	53.7	39.2	49.7	34.7
Philadelphia	81.70	.50	.95	3.95	9.75	220.00‡	275.00‡	1.05*h*	2.75*h*	54.2	39.7	50.2	35.2
Pittsburgh	86.02	.357*m*	.6585*m*	2.70*m*	6.625*m*	126.20	197.40	1.05*h*	2.50*t*	57.5*t*	42.0*t*	53.5*t*	38.5*t*
St. Louis	83.38	.40	.72	2.88	6.53	.....	.....	1.10*t*	2.25*t*	54.1	39.6	49.2	34.2
San Francisco	98.50	.438*d*	.878*d*	3.69*d*	9.23*d*	169.00*dl*	265.00*dl*	69	2.85	....	....	....	....
Seattle	100.30	.45*b*	.81*b*	....	....	72.50*e*	.....	.595	1.80	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, CL, Burlington, N. J. (base) $79.50. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Extra strength ASTM C 200-44T. *c* 4-in. *d* SS361-A. *e* 30 in. *g* Culvert pipe. Reinforced, ASTM C76-41. *h* Reinforced. ASTM C75-41. *i* Reinforced. ASTM C76-37. *j* Centrispun. *k* Per 100 ft. *l* F.o.b. plant. *m* Truck delivery. *o* Listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per ft. *s* Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ½ in., 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. *u* ASTM C13-40. *v* F.o.b. city. *x* 2 ft. lengths. *y* 3 ft. lengths. *z* CESA A60-1941 specifications used. *aa* No standard specifications in Can. *bb* Freight allowed to destinations in city. *cc* Truck loads; f.o.b. plant, Newton. *dd* LCL, delivered, f.o.b. truck. ** Recent 10% emergency freight rate increment granted railroads on Oct. 13 not included.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld — 1 in. and 1¼ in. black, 34 galv., 16; 1¼ in. black, 38 galv., 18½; 2 in. black, 37½ galv., 18. Lap weld — 2½ in. to 3½ in. black, 31½ galv., 14½; 4½ in. to 8 in. black, 32½ galv., 17. Freight rates to destination to be added to name delivered price.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) — All Fir planks No. 2 common, Fir timber as No. 1 common. Lengths up to 20 ft. (Prices in italics)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight incre... (See note for base...	
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 R/A	6x12 R/A	12x12 R/A	2x12 R/A	12x12 R/A	⅜"	½"
Atlanta	**$72 00**	**$72 00**	**$62 00**	**$62 00**	**$62 00**	**$62 00**	**$82 00**	.....	.....	.....	.....	**$20.46**	**$24.07**
	85 00	*85 00*	*95 00*	*95 00*	*95 00*	*95 00*	*85 50*	*$85 50*	*$85 00*	.....	.....	.....	.....
Baltimore	**95 48**	**96 00**	**96 00**	**94 80**	**99 20**	**103 60**	**114 50**	.....	.....	193.60	181.50	20.96	25.58
	105 80	*108 00*	*112 30*	*111 20*	*114 00*	*114 00*	*121 00*	*121.00*	*121 00*	.....	.....	.....	.....
Birmingham	**87 50**	**87 50**	**87 00**	**86 00**	**87 00**	**90 00**	**110 00**	.....	.....	110.00	112.50	19.97	24.37
	92 50	*92 50*	*92 00*	*91 00*	*92 00*	*95 00*	*114 00*	*97 00*	*98 00*	.....	.....	.....	.....
Boston	70 00[3]	72 00[3]	66 50[3]	68 50[3]	70 50[3]	74 50[3]	70 25[3]	.....	.....	.....	.....	20.96	25.58
	64 25[i]	*64 25[i]*	*62 25[i]*	*63 25[i]*	*62 25[i]*	*62 25[i]*	*60 50[i]*	*59 50[i]*	*59 50[i]*	*59 50[i]*	*59 50[i]*	.....	.....
Chicago	‡ **100 00**	**104 00**	**93 00**	**93 00**	**93 00**	**100 00**	**100 00**	.....	.....	125.00	125.00	17.16	20.90
	‡ *103 00*	*108 00*	*100 00*	*100 00*	*100 00*	*105 00*	*105 00*	*105.00*	*105 00*	.....	.....	.....	.....
Cincinnati	**89 00**	**91 00**	**90 00**	**88 00**	**90 00**	**92 00**	.....	.....	.....	100.00	135.00	19.97	24.37
Cleveland	*k* **110 00**	**120 00**	**120 00**	**120 00**	**120 00**	**125 00**	**130 00**	.....	.....	130.00	130.00	20.35	24.86
	k 115 00	*130 00*	*130 00*	*130 00*	*130 00*	*130 00*	*130 00*	*130.00*	*130.00*	.....	.....	.....	.....
Dallas	**68 00**	**68 00**	**58 00**	**55 00**	**57 00**	**62 00**	**57 00**	.....	.....	95.00	90.00	17.16	20.90
Denver	*95 00*	*95 00*	*96 50*	*96 50*	*96 50*	*96 50*	*105 00*	*110 00*	.....	.....	.....	12.76	15.57
Detroit	**98 00**	**98 00**	**90 00**	**90 00**	**95 00**	**93 00**	**93 00**	.....	.....	90.00	105.00	19.97	24.37
	98 00	*98 00*	*92 00*	*92 00*	*95 00*	*95 00*	*100 00*	*100.00*	*105 00*	.....	.....	.....	.....
Kansas City	*a* **105 00**	**110 00**	**105 00**	**105 00**	**105 00**	**105 00**	**110 00**	.....	.....	125.00	.....	15.18	18.48
	105 00	*110 00*	*110 00*	*110 00*	*110 00*	*110 00*	*115 00*	*110 00*	*115 00*	.....	.....	.....	.....
Los Angeles	*a 103 00*	*103 00*	*103 00*	*102 00*	*102 00*	*102 00*	*105 00*	*115 00*	*105 00*	.....	.....	12.27*gh*	14.91*gh*
Minneapolis	‡*b* 112 00[3]	112 00[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	15.18	18.48
	‡*b 108 00*	*108 00*	*108 00*	*108 00*	*108 00*	*110 00*	*130 00*	*130 00*	*130 00*	.....	.....	.....	.....
Montreal	*c*[3] 69 00	70 00	64 00	68 00	70 00	75 00	.....	.....	.....	.....	.....	.....	.....
	97 00	*97 00*	*97 00*	*97 00*	*97 00*	*97 00*	*82 00*	*82 00*	*82 00*	.....	.....	.....	.....
New Orleans	**60 00**	**60 00**	**60 00**	**60 00**	**60 00**	**65 00**	**105 00**	.....	.....	.....	.....	17.16	20.90
	61 00	*61 00*	*58 50*	*56 50*	*58 50*	*54 50*	*60 00*	*60.00*	.....	.....	.....	.....	.....
New York	‡ **105 110**	**105 110**	**Range from $95 00 to $99 00**				**120 00**	.....	.....	.....	.....	20.96	25.58
	‡		*Range from $115 00 to $125 00*				*115 125*	*115 125*	*115 125*	.....	.....	.....	.....
Philadelphia	**110 00**	**110 00**	**110 00**	**110 00**	**110 00**	**110 00**	**110 00**	.....	.....	150.00	150.00	20.96	25.58
	120 00	*120 00*	*120 00*	*120 00*	*120 00*	*120 00*	*120 00*	*120.00*	*120.00*	.....	.....	.....	.....
Pittsburgh	**59 40**	**61 80**	**71 85**	**63 60**	**69 45**	**73 10**	**89 85**	.....	.....	130.60	141.00	20.68	25.19
	77 60	*76 70*	*74 20*	*78 90*	*78 80*	*74 85*	*91 85*	*96 85*	*96 96*	.....	.....	.....	.....
St. Louis	‡*j* **105 00**	**105 00**	**100 00**	**100 00**	**105 00**	**105 00**	**115 00**	*140 00*	*140 00*	.....	.....	17.16	20.90
	‡*j 115 00*	*115 00*	*120 00*	*120 00*	*120 00*	*120 00*	*125 00*	.....	.....	.....	.....	.....	.....
San Francisco	*d 76 50*	*76 50*	*76 50*	*76 50*	*76 50*	*74 50*	*74 00*	*74 00*	*74 00*	.....	.....	9.24*g*	11.28*g*
Seattle	*70 00i*	*70 00i*	*70 00i*	*70 00i*	*70 00i*	*70 00i*	*75 00i*	*75 00i*	*75 00i*	.....	.....	.....	.....

Bold Face type, Southern Pine. *Itahes, Douglas Fir.* [3] Spruce. [i] Western Pine. No. 3 Common. Norway Pine. ‡Delivered. *a* Yard prices. *b* Retail prices, less than CL. *c* 5 M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's truck or carrier, San Francisco paid). *e* Tax exempt. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 5000 ft. lots. *k* These are retail yard prices quoted per truckload in Greater Cleveland. Less 2% for cash. Truck lots.

Note: Special concrete form grade Fir Plywood, 4′ by 8′ panels, 5-ply; sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ⅜", $151.00; on ½", $171.00. For other centers add rail freight increment from table on proper size. For oiling add $3.00; for edge sealing add $2.00; for resin sealing add $8.50.

* Freight rates include 10% emergency increase granted railroads on Oct. 13.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Jan. 16, 1946 — Single or Double Thickness — A quality	B quality	EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*
Atlanta	76%	76%	$0.195
Baltimore	70-10%	71-10%	.195
Birmingham	68%	68%	.15
Boston	77%	78%	.195
Chicago	68%*e*	68%*e*	.195
Cincinnati	67&10%*i*	67&10%*i*	.195
Cleveland	67-10-10%	67-10-10-10%	.235
Dallas	67%*e*	68%*e*	.2075
Denver	68%	68%	.20
Detroit	77%	76%	.195
Kansas City	68-10%*i*	68-10%*i*	.20
Los Angeles	63%	68%*h*	.2025
Minneapolis	68%	68%	.20
Montreal	40-5%*ab*	40-10-5%*ab*	.....
New Orleans	68%	68%	.205
New York	73%	74%	.265*f*
Philadelphia	69%	70%	.195
Pittsburgh	77-10%	77-10%	.1675
St. Louis	70-10%	70-10%	.20
San Francisco	66%	73%	.20
Seattle	50%	60%	.2025

Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%

a Discount from list, Sept., 1939; sales tax included, but 3% tax exemption not allowable for. *b* Single thickness. *d* Discount from jobbers list Sept. 15, 1928. *e* Discount from list of Jan. 20, 1947. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $9.00 per ton. *g* Discount from list of Aug. 15, 1938. *h* Single thickness. Double thickness, 67%.

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C. L. 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.155 – .1625	.18 – .1925	.20 – .2125
Rocky Mtn. States	.155 – .1675	.18 – .1975	.20 – .2175
Pacific N. W. States	.1525– .165	.1825–.195	.2025–.215
Pacific S. W. States	.15 – .1575	.18 – .1875	.20 – .21

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in. — 2-ft. from butt	6-in	50 to 59-ft.	.35	....
12-in. — 2-ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in. — 2-ft. from butt	6-in.	90 to 100-ft.	....	.57
13-in. — 3-ft. from butt	5-in.	91 to 100-ft.	....	.62
14-in. — 2-ft. from butt	6-in.	50 to 69-ft.	.41	.69
14-in. — 2-ft. from butt	6-in.	70 to 79-ft.	.43	.61
14-in. — 2-ft. from butt	5-in.	80 to 85-ft.	.54	.63
14-in. — 2-ft. from butt	5-in.	85 to 89-ft.	.57	.64
14-in. — 2-ft. from butt	5-in.	90 to 100-ft.	....	.68

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.45	....	$2.00	....
	Pine	1.35	$3.05*a*	1.90	$4.00*a*
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	....	2.27*a*
Chicago	Red Oak	....	2.35/2.40*a*	....	3.25/3.40*a*
Los Angeles	Douglas Fir	2.10	3.35*a*	3.00	4.80*a*
Philadelphia	Red Oak	2.25	3.05*ag*	3.00	4.15*ag*
St. Louis	White Oak	1.80	....	2.50	....
	Red Oak	....	2.40*a*	....	3.40*a*
	Sap Pine or Cypress	2.20	....	....	....
San Francisco	Douglas Fir	1.50*ef*	2.70*f*	2.00*bf*	3.78*af*
Montreal	Birch or Maple	*h*	....*h*	....*h*	....*h*

Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 7" x 9" x 8'. *c* Empty cell. *e* Green. *f* F.o.b. cars. *g* January, 1943 price, none later available. *h* No constant price available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$3.75
Chlorine cylinders, liquid, per lb. delivered	.07–.12
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	21.50–38.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.55
Soda ash, 58%, in paper bags, per 100 lb. dense	1.38
Sulphate of aluminum, commercial, in 100-lb. bags	1.15–1.30
Sulphate of copper, in bgs., per 100 lb.	7.60

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over.			STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over.			BRICK Per M. in quantity		LIME		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	Pulverized or lump
Atlanta							$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	$120.00	$126.00	$220.00	$240.00	$315.00	$340.00	27.00*i*	32.00*k*	30.00	18.00	
Birmingham	97.50	104.00	195.00	231.00	.....	.....	20.00*ff*	22.50*gg*	21.80	17.50	
Boston	105.00*t*	112.00*t*	210.00*t*	252.00*t*	.....	.....	20.00*i*	20.00*i*	21.00*t*		16.00
Chicago	115.00	122.50	230.00	.....	.....	.....	20.00	21.00	25.00	18.00	.....
Cincinnati	120.00*j*	135.00*j*	170.00*kkl*	280.00*j*	.....	.....	33.00	33.00	25.60	23.20	.....
Cleveland	107.50*cc*	114.50*cc*	210.50*cc*	.....	.....	.....	25.50	25.50	21.15	19.15	23.25*ee*
Dallas	.....	83.00	.....	.....	.....	.....	18.00	20.00	28.00	22.00	
Denver	.....	.....	.....	.....	.....	.....	26.00	31.00	34.80*ll*	28.00*ll*	34.00*ll*
Detroit	130.00	145.00	260.00	300.00	380.00	443.30	27.00*f*	29.00*f*	28.00	26.00	26.00
Kansas City	.....	.....	.....	.....	.....	.....	16.00	18.50	34.00	30.00	30.00
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	24.00	.....	26.00	26.00	27.00
Minneapolis	144.00*p*	160.00*p*	.....	160.00*ep*	.....	.....	23.50*p*	.....	33.00*hh*	24.00*hh*	33.00*hh*
Montreal	92.50*a*	98.50*a*	196.25*a*	151.50*aa*	.....	294.40*a*	22.16	31.86	12.50*nn*	14.00*a*	8.00*nn*
New Orleans	160.00	160.00	300.00	380.00	411.89	485.91	22.50	.....	21.20	18.00	14.10
New York	103.90	110.80	152.35*e*	166.70*hn*	.....	.....	28.00	.....	33.50	25.50	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	26.75	17.00	17.00
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	26.00	28.00*ii*	19.00	16.00	2.85*m*
St. Louis	106.92	119.30	220.71	231.57	287.28	319.20	28.50*ll*	26.50*n*	72*nnnp*	55*nnnp*	82*nnnpee*
San Francisco	124.00	139.50	186.00*kll*	139.50*r*	.....	.....	27.50	.....	23.10	23.10	2.31*m*
Seattle	137.00*cc*	147.00*cc*	.....	147.00*eeee*	.....	.....	28.50	33.50	27.95*n*	27.95*n*	3.28*m*

† F.o.b. *a* Smooth. *b* Per 50 lb. bags. *c* 6 x 12 x 12 in.-3 cell. *d* Pulverized hot. *e* 5% discount for cash. *f* Includes $3.50 per M for truck delivery. *g* 5½ x 8 x 12. *h* F.o.b. Perth Amboy, N.J. *i* F.o.b. warehouse only. *j* Truck load or over. *k* $1.00 discount. *l* Red face. *m* Per bbl., 180 lb. *n* 7½ x 7½ x 12. Speed tile. *o* Per bbl., 200 lb. *p* Truck lots. *r* Not used because of earthquake danger exempt. *s* Sand lime. *u* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime not sold per ton. *bb* LCL. *cc* Truck delivery. *dd* 6 x 12 x 12. *ee* Pebble lime. *ff* 80% common. *gg* Select. *ii* 5½ x 8 x 11½. *ll* Tax exempt. *nn* Price per ton. *ppp* 2% discount for cash. *qq* Pebble lime price per ton.

PAINT, ROOFING — F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl	WHITE LEAD Per 100 lb. in 100 lb. cases	READY-MIXED PAINT			ROOFING SUPPLIES Carload lots f.o.b. factory				
	Dry *a*	In oil *w*	Graphite *b*	Per gal., drums Aluminum *c*	Ferric Oxide *d*	Rolls, slate surfaced, 85-90 lb. per sq.	Asphalt-felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl per ton
Atlanta	$18.85	$27.375	$1.75	$2.70	$1.65	$2.06‡	$2.06‡	$2.06‡	$1.00‡	$36.00‡
Baltimore	18.60	27.00	2.25	3.50	2.75	2.50	3.00	3.00	.50	30.00
Birmingham	18.85	27.375	4.40	4.52	...	2.84	2.70	2.70	.40	34.50
Boston	18.60	27.00	1.75	2.50	2.31	2.00‡*k*	3.30‡*q*	3.30‡*q*	.25‡	21.00
Chicago	18.60	27.00	....	....	....	2.50‡	2.63‡*o*	2.65‡*o*	31.00*bb*‡	31.00‡
Cincinnati	18.60	27.00	....	3.15	1.90	2.21	2.26*o*	2.26*o*	.37*y*	34.00
Cleveland	18.60	27.00	3.00	3.00*n*	3.00	2.21	2.26*o*	2.26*o*	.31*y*	33.00
Dallas	18.60	27.00	....	4.05	...	2.69*q*	3.00*q*	3.15*q*	.90	45.00
Denver	18.60	27.50	2.88	4.38	2.63	2.04*o*	2.24*o*	.....	.42	32.00
Detroit	18.60	27.00	2.25	3.00	2.00	2.25	2.25	2.25	.50	25.00
Kansas City	18.60	27.125	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.50	.54	.....
Los Angeles	18.85	27.50	2.80	4.00	3.50	2.68	2.96	*t*	.77	*t*
Minneapolis	18.60	26.13*m*	...	...	...	2.10*m*	2.15*hm*	2.15*hm*	.37*m*	28.00*m*
Montreal	.....	17.85	2.90*p*	4.20*p*	3.62*p*	2.85*t*	2.58*tf*	2.07*tf*	.68*t*	1.85*tt*
New York	18.60	27.00	3.45	....	3.45	2.10	2.15*o*	2.15*o*	.30*z*	26.00
Philadelphia	18.60	27.00	1.75-2.00	2.40	1.70	2.54	2.94	2.94	.37	26.00
Pittsburgh	18.60	27.00	2.05	2.50	1.90	2.32	2.37*o*	2.37*o*	.37	32.00
St. Louis	18.60	27.00	....	....	....	2.66	2.66	2.66	.38	31.00
San Francisco	18.85	27.25	1.80	2.75*n*	1.35	2.27*x*	3.30*xx*	.....	.38*y*	...
Seattle	18.85	27.50	2.95*m*	2.95*m*	....	3.00*mq*	3.07*hm*	.....	.48*m*	35.00*m*

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* 15 lb per square. *f* Per 432 sq. ft. *g* 50 gal. drums. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *l* Not used. *m* 1% discount for cash. *n* Max., 1941 price. *o* Per 60-lb. roll. *p* Tax included. *q* Per 100-lb. roll. *r* F.o.b. factory, Chicago. *s* ASTM Spec. D266-41. *t* Federal tax included. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55 gallon container. *z* Drums. *aa* Approximate cost per 100 lbs. *bb* Roofers coating and cement. Price per ton.

SKILLED AND COMMON WAGE RATES — PER HOUR

	Brick-layers	Car-penters	Struct. Iron Workers	Hoisting Engineers	Plas-terers	Electrical Workers	Steam-fitters	Common Labor Building	Common Labor Heavy Const.
Atlanta	$2.00	$1.65	$2.00	$2.00	$2.00	$1.80	$2.00	$0.75	$0.85
Baltimore	2.50	1.95	2.15	2.20-2.40	2.00	2.00	2.00	1.10	1.10
Birmingham	2.25	1.625	1.90	1.60-1.875	2.00	2.00	2.00	.85	.95
Boston	2.15	1.90	2.00	2.25	2.25	2.15	2.00	1.40	1.40
Chicago	2.20	2.15	2.20	2.15	2.225	2.15	2.15	1.50	1.50
Cincinnati	2.25	1.975	2.10	2.00	2.125	2.125	2.125	1.25	1.15
Cleveland	2.25	2.125	2.25	1.875-2.125	2.125	2.125	2.125	1.55	1.40
Dallas	2.00	1.875	2.00	2.00	2.125	2.00	2.125	.95	.95-1.50
Denver	2.25*b*	1.875	1.875*b*	1.875*b*	2.25	2.05	2.05	1.275	1.35
Detroit	2.25	2.025	2.25	2.25	2.25	2.25	2.165	1.425	1.425
Kansas City	2.25	1.90	2.05	2.125	2.25	2.025	1.875	1.325	1.325
Los Angeles†	2.375	1.90	2.10	1.85	2.25	2.15	2.25	1.35	1.35
Minneapolis	2.075	1.80	2.00	1.85	2.25	2.06	2.00	1.30	1.30
New Orleans	1.9375	1.625	1.875	1.75	1.875	2.00	2.05	.90	.90
New York	2.75*b*	2.50*b*	2.75	2.75*b*	3.00*a*	2.25*a*	2.75*b*	1.50	1.50
Philadelphia	2.40-2.50	2.00	2.40	2.25	2.25	2.25	2.25	1.10	1.10
Pittsburgh	2.50	2.25	2.25	2.40	2.25	2.25	2.25	1.30	1.30
St. Louis	2.25	2.20	2.25	2.40	2.25	2.25	2.25	1.35	1.50
San Francisco	2.25	2.00	2.25	2.00	2.25	2.25	2.25	1.40	1.40
Seattle	2.235	1.935	2.135	1.95	2.235	2.135	2.345	1.535	1.45
Montreal*	1.40	1.06	1.11	1.00	1.17	1.11	1.11	.73	.67

a Hr. day. *b* 7 hr. day. * Cost of living bonus now included in basic wage. † Unchanged since middle of 1947.

MEXICO CITY PRICES

In Pesos, F.o.b. City		Oct. '47	Nov. '47
Common Wages—Building (8 hr. day)	av. per hr.	.57	.57
Common Wages—Heavy Const. (8 hr. day)	av. per hr.	.75	.75
Skilled Labor Wages			
Carpenters (8 hr. day)	av. per hr.	1.25	1.25
Bricklayers (8 hr. day)	av. per hr.	1.25	1.25
Struct. Iron Workers (8 hr. day)	av. per hr.	1.50	1.50
Struct. Steel Shapes 3" 15" x 12 meters	per ton	800.00	800.00
Reinf. Steel, Corr. Rods 4" x 12 meters	per ton	1,000.00	1,000.00
⅜" x 12 meters	per ton	955.00	955.00
½" x 12 meters	per ton	940.00	940.00
⅝" x 12 meters	per ton	940.00	940.00
¾" x 12 meters	per ton	930.00	930.00
1" x 12 meters	per ton	925.00	925.00
Gravel, truck load of 3½ cu. meters Blue Gravel	per tr. load	33.00	33.00
Rose Gravel	per tr. load	28.00	30.00
Cement, Std. Port. (Toltesa)	per ton	115.00	115.00
Lumber Mex. Sacred Fir (Oyamel)	per M ft.	370.00	370.00
1st Class Pine	per M ft.	700.00	700.00
2nd Class Pine	per M ft.	460.00	460.00

ENR Skilled Average: Bricklayers, Carpenters, Ironworkers) $2.12. **ENR Common Average:** $1.26.

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

(Number refers to item directly below it)

67

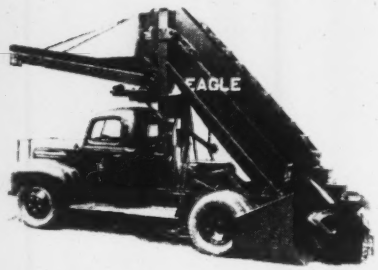
GASOLINE ENGINE—Compact utility tractor made by Lincoln Tractor Co., of Arcadia, Calif., has 6-hp. air-cooled engine with pressurized lubrication. Engine weighs 56 lb. and occupies only 1⅛ cu. ft. of space. Tractor has all-steel welded frame, pivoted front axle suspension, individual rear wheel brakes to facilitate turning and transmission providing three forward speeds and two power take-offs.—*Salsbury Motors, Inc., Northrop Aircraft, Inc.*, 1201 *E. Lexington St., Pomona, Calif.*

68

PORTABLE SUPPLY TANK—Designed for use with self-propelled roadmixer, Model 36 (or Models 48 and 54) and other traveling mixing plants is 1500-gal. single compartment portable supply tank, which is used for carrying all types of binder fluids. Roper pump powered by Chrysler industrial engine is mounted at front and used to load tank, to transfer fluids from tank to mixing drum on roadmixer or travel plant, and to circulate fluids within tank while heating.—*Wood Mfg. Co., Box 620, 6900 Tujunga Ave., N. Hollywood, Calif.*

69

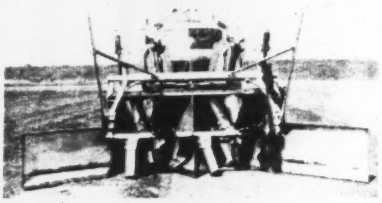
TRUCK-MOUNTED LOADER—Model 400 loader, with positive crowd, features full hydraulic controls operated from platform just behind truck cab. Loader is operated by one man, and has 3-to-5-yd. per minute capacity.



Overall height is only 11 ft. 10 in. Conveyor belt discharge operates through 180-deg. swing; is capable of discharging wet material without depending on gravity flow. Approximate weight complete is 11,500 lb. Loader mounts on any 1½ or 2-ton truck, with power supplied by truck engine through power takeoff from transmission.—*Eagle Crusher Co., Inc., Galion, Ohio.*

70

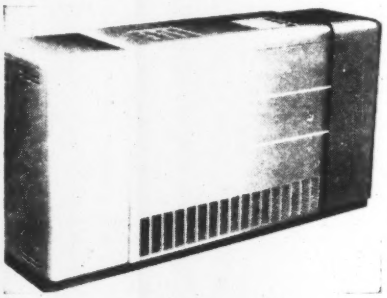
ROTARY SNOW PLOW—New snow plow units may be mounted on four-wheel drive trucks, F.W.D., Marmon-Harrington and Walters. The largest unit will travel at 20 to 25 mph. in snow 6 or 7 in. deep. The plow makes



a 14-ft. cutting and casts the snow 150 ft. Total capacity is 51 tons of snow per minute. The rotary on each truck is run by an independent motor, and a light as well as a heavy unit is available. The heavy unit is powered by a 275-hp. LeRoi motor mounted on the back of the truck. The smaller unit has a 170-hp. LeRoi motor.—*William Bros. Boiler & Manufacturing Co., Minneapolis, Minn.*

71

UNIT VENTILATOR—A unit ventilator for schoolrooms, auditoriums and industrial installation has Trane resilient belt drive mechanism, making operation of the unit more efficient and quiet, and heat distribution more even. Standard motors can be used. The



cabinet has been redesigned to blend with any room, and rounded corners make it particularly safe. A recessed scuffboard across the entire front eliminates unsightly mars. The ventilator uses the non-freeze or steam distributing coil, which prevents freeze-ups, of solderless, mechanically bonded fin-to-tube construction.—*The Trane Co., La Crosse, Wis.*

(*Continued on page* 138)

IF YOU WANT MORE INFORMATION on new products or manufacturers' publications, mark the identifying item numbers on the coupon below, and mail. No cost or obligation to you.

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BYERS WROUGHT IRON PIPE Can take it!

Digester tanks aren't usually planned for periodical inspection. Once put in service, they operate constantly till trouble forces a shutdown. The longer they run, the better for all concerned—and that's where Byers Wrought Iron pipe comes in!

The heating coils in digester tanks must take a terrific beating. Corrosive action increases as the temperature rises. (Some authorities estimate that the corrosion rate is doubled for each 20° F. rise in temperature). Then, too, sludge tends to collect on the surface of the pipe, and under high temperatures it decomposes and liberates highly corrosive compounds. All this means that the digester coils must have an unusually high degree of resistance to corrosion.

Byers Wrought Iron pipe is serving in this punishing service in plants all over the country. Its superior resistance to the unusually severe corrosive attack has been demonstrated over and over again.

The reason for this excellent performance is found in the unique composition and structure of wrought iron. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting. They also help anchor the initial protective scale, which shields the underlying metal.

You will find some helpful information on the application of corrosion-resisting materials in our bulletin, "Wrought Iron for sewage treatment and disposal installations." May we send you a copy?

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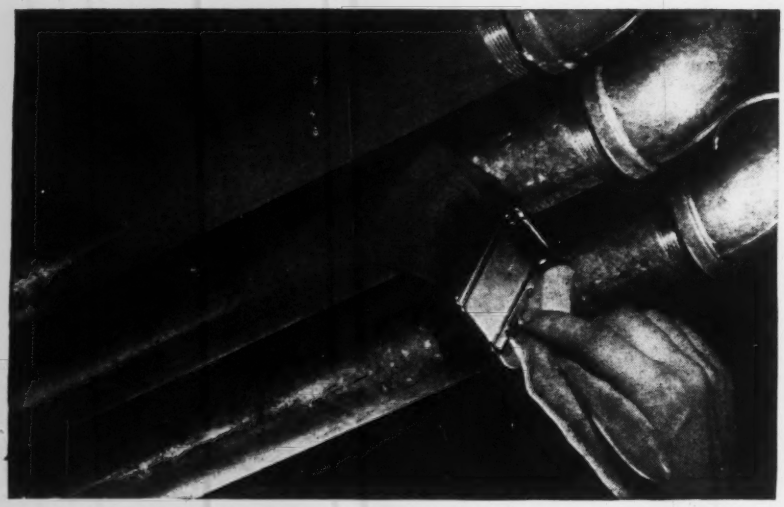
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



It Can't Rust Now!

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("Sure Rust Prevention")

PUTS A RUST PREVENTIVE COATING ON IRON, STEEL AND GALVANIZED IRON SURFACES

Here's "Sure Rust Prevention" for both new and old metal! S.R.P. really digs into the metal surface, forming an impenetrable protective coating against corrosive salts, moisture, acid fumes and vapors, and weather exposure.

S.R.P. is easy to apply – needs no expensive preparation – goes on like paint – and you don't have to remove existing rust. S.R.P. penetrates through and combines with rust already formed, bonds firmly with clean metal, and forms an impermeable coating against air as well as moisture. It provides an exceptionally elastic film, free of pinholes, which expands and contracts with the metal to which it is applied.

Protect piping, fences, structural members and sheet metal surfaces with S.R.P. 75 Primer; then finish with either S.R.P. 87 (Red or Black) or SONOLASTIC Aluminum Paint (Ready-Mixed).

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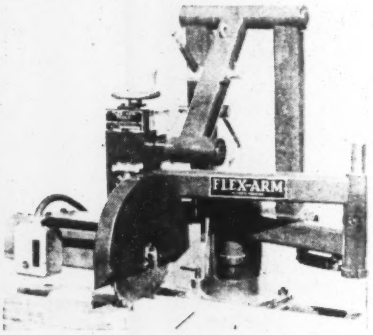
IF IT'S WORTH BUILDING IT'S WORTH SAVING

Building Products Division, **L. SONNEBORN SONS, INC.,** New York 16, N. Y.

In the Southwest: Sonneborn Bros., Dallas 1, Texas

72

RADIAL SAW—Flex-Arm portable saw provides complete flexibility and immediate dial setting for any cut at any angle. It is powered by 2-hp.



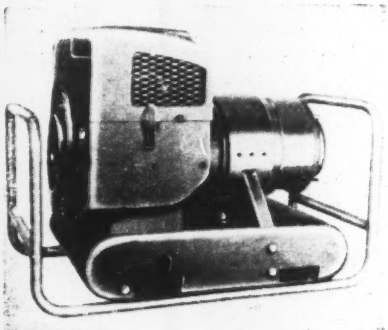
direct drive universal single phase motor, 115 v., 25-60 cycle a.c.-d.c., 5,700-rpm. load speed. Removable rip guard is equipped with anti-kickback dogs and can be lowered to cover blade and shaft. Weight complete is 233 lb.—*Flex-Arm Mfg. Corp., 401 S. Pasadena Ave., Pasadena 2, Calif.*

73

CENTRIFUGAL PUMPS — Overall housings for self-priming centrifugal pumps protect engine as well as pump from weather and dirt. Side panels give instant access to all operating controls. "Inherent" priming action is combined with "jet" priming. Replaceable liners, self-cleaning shell design and open-type impellers adjustable for wear are other features. *Jaeger Machine Co., Columbus 16, Ohio.*

74

ELECTRIC PLANTS—New 5,000-w. electric plant, known as 5CK-115M, weighing only 272 lb., is one of improved group of plants employing new CK air-cooled, four-cycle, two



cylinder-gasoline engine as prime mover. It will produce about 1 kwh. of electricity per quart of gasoline. Plants are available in 60 or 50-cycle a.c. (2,000 and 3,000 w.) and d.c. (5,000 w. and 3,500-w. battery charger) portable or stationary.—*D. W. Onan & Sons, Inc., Minneapolis 5, Minn.*

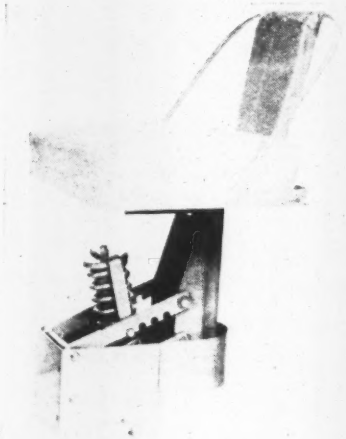
(*Continued on page* 143)

75

SAW RIG—Portable saw rig cuts full 2-in. lumber. Blade protrudes 2½ in. through top of table. Heavy-duty mandrel is connected through multiple V-belt drive to single-cylinder, four-cycle air-cooled gasoline engines. Several different sizes of engines and electric motors are available.—*Sterling Machinery Corp., 411 Southwest Blvd., Kansas City, Mo.*

76

TRACTOR SEAT SUPPORT—Flow-Ting, hydraulic type seat support with weight adjusting features, combines hydraulic shock absorber built inside soft coil spring. This design provides two-way action whereby soft coil



spring goes down easily with any impact and shock absorber retards return action of spring. Adjustable for weight of any person, from 75 to 275 lb. Another feature maintains constant seat level regardless of terrain. It is adaptable to all popular makes of tractors.—*Knoedler Mfrs., Dept. R-9A, Streator, Ill.*

77

SLIDE RULE—The Dualog slide rule is 9½ in. in diam. on white vinylite. It is a scientifically designed computing instrument and is intended for the rapid solution of mathematical problems involving multiplication, division, proportion, trigonometric functions, logarithms, exponential equations, square and cube roots and powers. The log scales provide means for the direct extraction of any root or power of numbers.—*Tavella Sales Co., 25 West Broadway, New York 7, N. Y.*

78

RESIN SHEETING—Phosphorescent acrylic resin sheeting is now available in commercial quantities. It contains

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Send me catalog(s) indicated.

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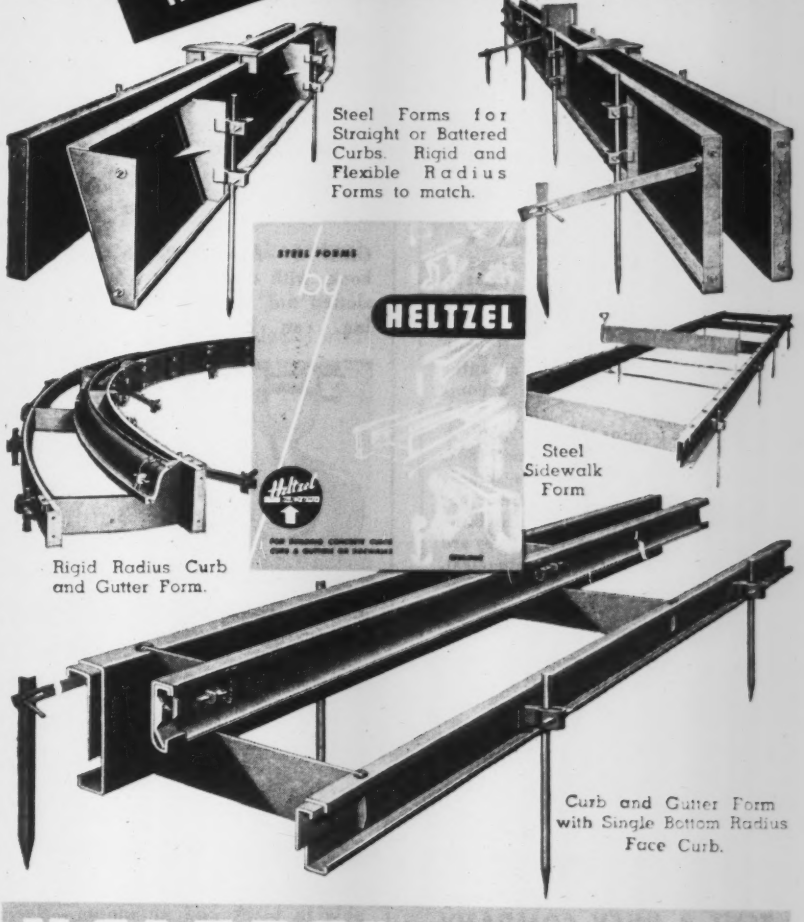
(Type of construction usually engaged in)


Steel Forms for Straight or Battered Curbs. Rigid and Flexible Radius Forms to match.
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pigments that causes it to glow for 12 hr. after exposure to ordinary light. It promises to be valuable in both indoor and outdoor applications where continuous lighting is desirable. It can be used for directional signs and dial faces.—*E. I. duPont de Nemours and Co., Inc., Wilmington 98, Del.*

79

FORK LIFT TRUCK ACCESSORY—Sideshifter permits operator to pick up or deposit unit load in an exact location, without repositioning truck. It provides lateral movement of load, on

forks or pallet, to either side. Hydraulically operated through double-acting cylinder, it will move carriage face and forks 3½ in. in either direction. Accessory is designed to operate with standard Towmotor forks or Priester or Schmidgall fork.—*Towmotor Corp., Cleveland 10, Ohio.*

80

CLEVIS HOOK—Newly developed hook, with clevis design utilizing bolt, slotted nut and cotter pin for fastening, can be easily attached and switched from one job to another, while meeting all safety requirements. It can be supplied with safety latch or with reversed jaw. It is made in 1½, 2, 3 and 5-ton sizes. All parts, including bolts, are of drop-forged, heat-treated steel. —*Thomas Laughlin Co., Portland 6, Me.*

81

WOOD PRESERVATIVE PAINT—Woodtrem is reputed to prevent rot and decay by penetrating deeply into wood surfaces and effectively sealing out moisture. Its creosote content is poisonous to bacteria. It is specially adapted for wood that is to be buried in the ground or laid on earth surface. Available in black and aluminum.—*Speco, Inc., 3142 Superior Ave., Cleveland, Ohio.*

(*Continued on page 146*)

Worthington-Ransome Blue Brute Distributors

See ad on page 145 for list of equipment in each line

Worthington-Ransome Distributors

Ala., Birmingham, Ragsdale Mach. Co., Inc.
Alaska, Anchorage, Airport Mach. & Storage Co
Ariz. Phoenix, Lee Redman Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son

Calif., Richmond, Bay Equip. Co.
Cal., L. A. Golden State Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., Wallingford, Wilhelm-Davies Co., Inc

Fla., Gainesville, Constr. Equip. & Supply Co., Inc.
Miami, Allied Equip. Inc.
Orlando, Highway Equipment and Supply Co
Tampa, Epperson & Company

Ga., Atlanta, Tractor & Machinery Company

Ida., Boise, Olson Manufacturing Co.
Ill., Chicago, Thomas Hoist Co.
Iowa, Cedar Rapids, McNall Mach. & Supply Corp

Kansas, Topeka, M. R. Salisbury Co.
Ky., Harlan, Croushorn Equip. & Supply Co.
Louisville, Williams Tractor Co.

Maine, Portland, N. A. Burkitt, Inc.
Mich., Muskegon, Lakeshore Machy. & Supply Co
Mich., Detroit, W. H. Anderson Co., Inc.
Minn., Minneapolis, Phillippi Murphy Equip. Co
Mass., Cambridge, Field Machy. Co.
Mass., West Springfield, E. F. Edson Co., Inc
Miss., Jackson, Jackson Road Equip. Co
Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co
Montana, Billings, Interstate Truck & Equip. Co.
Helena, Caird Eng. Works
Montana, Missoula, Miller Machinery Co.

Nevada, Elko, C. W. Paul Hardware and Machy. Co
N. Hampshire, Manchester, R. C. Hazelton Co., Inc
N. J., No. Bergen, American Air Comp. Corp
N. M., Albuquerque, Bud Fisher Co.
Roswell, Smith Machy. Co.
N. Y., Albany, Milton-Hale Machinery Co
N. Y., Buffalo, Morroy Equip. Co.
New York, Hodge & Hammond, Inc.
Syracuse, Milton-Hale Mach. Co.
N. C., High Point, Smith Equip. Co.
N. D., Fargo, Smith Commercial Body Works, Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll-Edwards & Co.
Toledo, The Kilcorse Machy. Co.
Okla., Oklahoma City, Tattan-Douglass Equip. Co.
Oregon, Portland, Andrews Machinery

Pa., Wilkes-Barre, Ensminger & Co.
Mechanisburg, American Equip. Corp
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Memphis, Hamilton Tractor Co.
Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co
Abilene, W. T. McClure Mach. Co.
Dallas, Shaw Equip. Co.
Houston, So. Texas Equip. Co., Inc.
San Antonio, Patten Machy. Co.
Tyler, D. M. McClure Equip. Co.

Utah, Salt Lake City, J. K. Wheeler Mach. Co

Vt., Barre, A. M. Flanders, Inc.
Va., Richmond, Highway Machy. and Supply Co

W. Va., South Charleston, Allied Equip. Co.
Wash., D. C., Paving Supply & Equip. Co.
Wash., Seattle Star Machy. Co.
Wisc., Milwaukee, Drott Tractor Co., Inc.

Ransome Distributors

La., New Orleans, Ole K. Olson Co.

N. Y., Buffalo, Murray Equip. Co.
N. Y., Rochester, B G Equip. Co.
O., Cleveland, H. B Fuller Equip. Co.
Pa., Pittsburgh, Arrow Supply Company.

Worthington Distributors

Ind., Indianapolis, Reid-Holcomb Company

La., New Orleans, Wm. F. Surgi Equip. Co

Md., Baltimore, D. C. Elphinstone, Inc.

O., Cleveland, Gibson-Stewart Co.
O., Columbus, Gibson-Stewart Co.

Pa., Allentown, H. N. Crowder, Jr., Inc.
Pittsburgh, Atlas Equip. Corp.

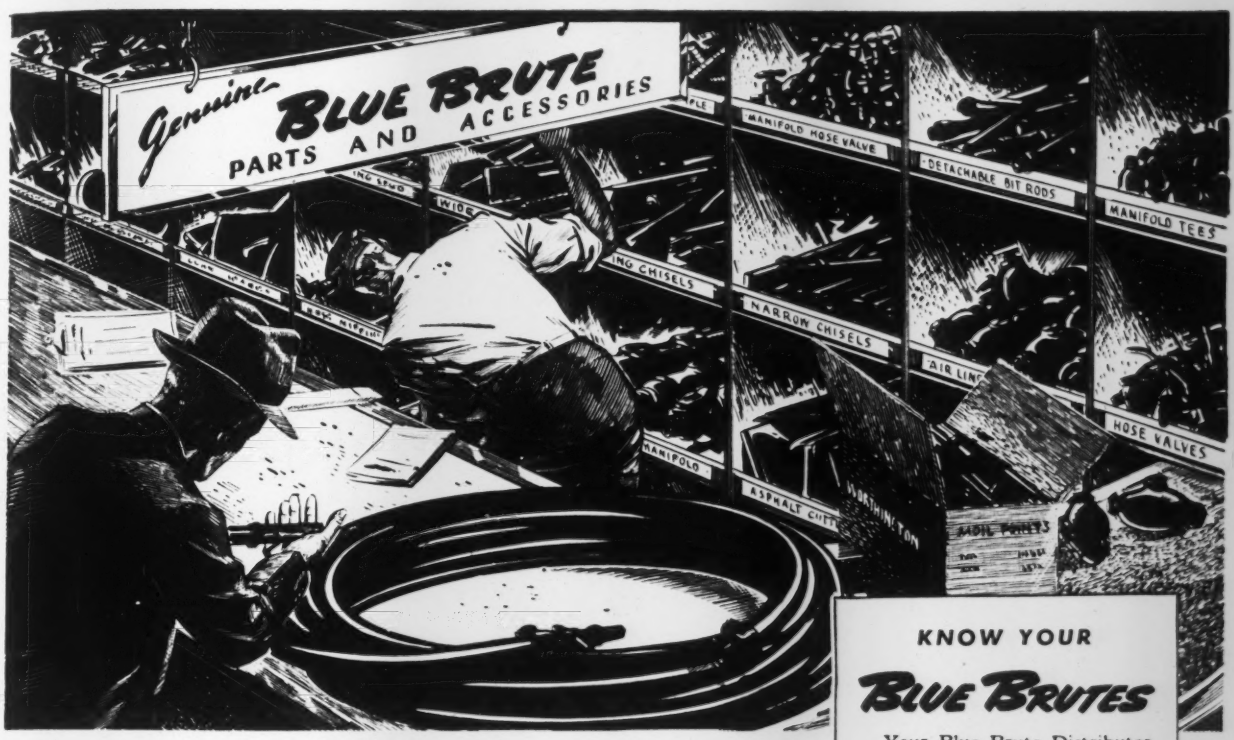
Texas, El Paso, Equip. Supply Co.

Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Buy Blue Brutes

Worthington Pump and Machinery Corp.
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts

JUST AS TOUGH AS THEIR BIG BROTHERS



You'll find Worthington Accessories as worthy of the Blue Brute name as the Rock Drills, Air Tools, Compressors and other "big shots" in this famous line. Air Hose, Paving Breaker Moil Points and Chisel Bits — Rock Drill Steel and Bits — Line Oilers, Valves, Couplings, etc. — all made to Blue Brute standards and thoroughly tested for the job to be done.

Save time, labor and money. Make sure you're equipped with genuine Blue Brute accessories for all mining or construction work. Rugged, hard working, always dependable, they'll quickly prove to you that *there's more worth in a Blue Brute.*

H7-8

KNOW YOUR

BLUE BRUTES

Your Blue Brute Distributor will be glad to show you how Worthington-Ransome construction equipment will put your planning on a profitable basis. His name is listed on Page 144.

RANSOME EQUIPMENT

Pavers, Portable and Stationary Mixers, Truck Mixers, Pneumatic Placing and Grouting Equipment and Accessories.

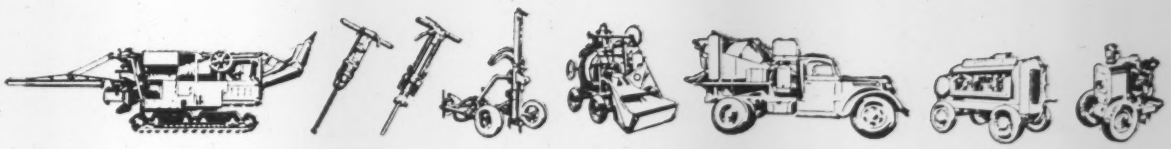
WORTHINGTON EQUIPMENT

Gasoline and Diesel Driven Portable Compressors, Rock Drills, Air Tools, Self-Priming Centrifugal Pumps and Accessories.

WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Mass.

BUY BLUE BRUTES



IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB

-but it meant a

$450,000 FIRE LOSS!

Put yourself in the place of the owners of this plant. Three of your buildings completely destroyed, with a fire loss of $450,000—all because your *fire protection did not protect.*

Not a pleasant situation—

But there is another side to the fire-protection picture. We call it the "Automatic" Sprinkler side. Long years ago "Automatic" Sprinkler established a course of action from which it has never deviated *—to produce fire protection systems and devices that answer the need for complete and adequate protection, no matter what the fire hazard.*

This policy has paid handsome dividends to users of "Automatic" Sprinkler equipment. It will continue to do so. For singleness of purpose, coupled with intelligent and persistent research, has resulted in *fire protection that really protects.*

"Automatic" engineers are well qualified to help solve your fire hazard problems. Write us today.

FIRE PROTECTION

DEVELOPMENT ENGINEERING

Automatic Sprinkler

MANUFACTURE INSTALLATION

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN 1, OHIO
OFFICES IN PRINCIPAL CITIES OF NORTH and SOUTH AMERICA

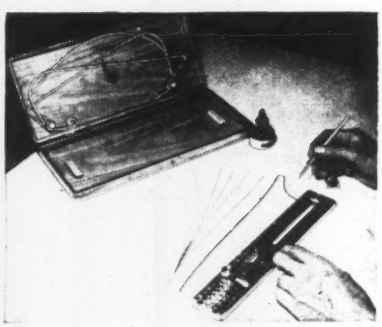
82

SNOW PLOW WAX—Penn Drake Wax, easily applicable to moldboards, blades and wings, creates hard, slick surface off which even wettest snow slides easily. It is applied with ordi-

nary paint brush. One gallon of wax covers about 300 sq. ft. of plow working surfaces. It also acts as rust preventive. Plow can be placed in service within few minutes after application.—*Pennsylvania Refining Co., 2686 Lisbon Lisbon Rd., Cleveland 4, Ohio.*

83

CURVE DRAWING INSTRUMENT—Infinarc, new device for drawing curves, is available with 12-in. base and four preformed wire curves with which it is possible to produce almost

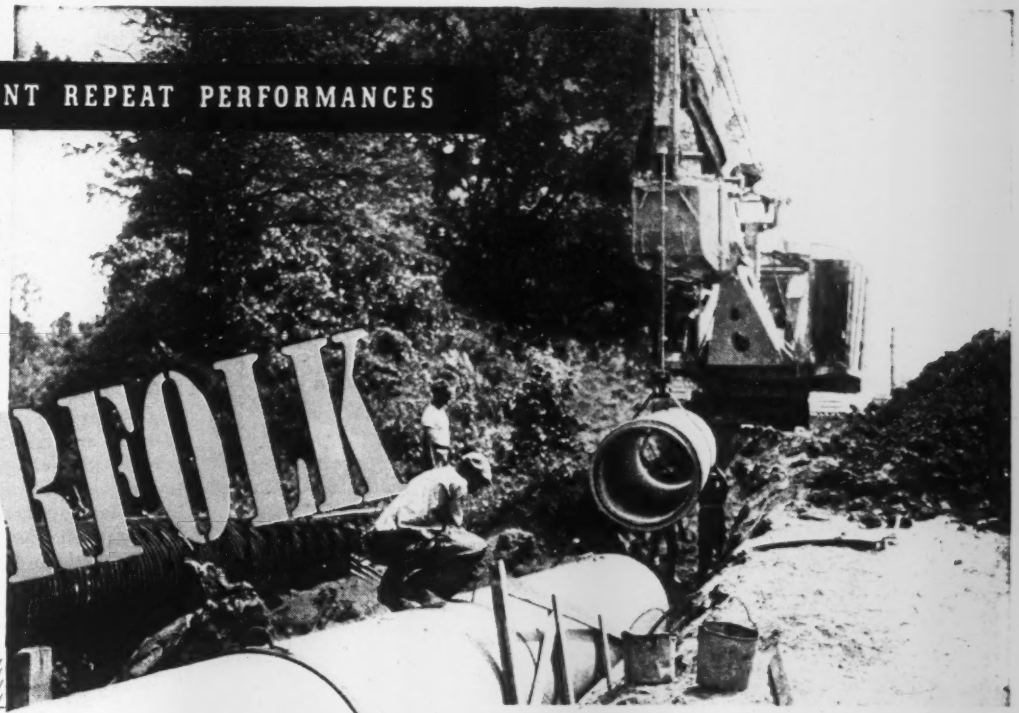


any shape desired, including reverse curves. Wires are easily and quickly interchanged by snapping loops over ends of adjustment screws. It is made entirely of stainless steel and comes in clear-lacquered wood instrument case.—*Cook Specialty Co., Green Lane, Pa.*

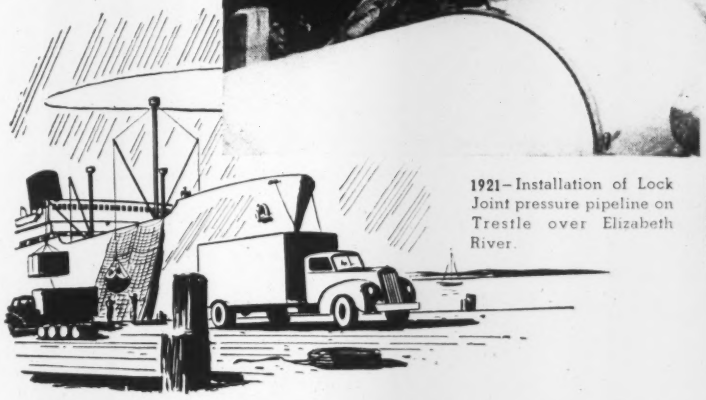
84

AIR ENTRAINING AGENTS—Avr-Trap is made in two forms—liquid, which employs only one pint per 5 cu. yd. of concrete, 6 bag mix; and powdered which employs one pound per cu. yd. of concrete, 6 bag mix. It is relatively independent of proportion of sand in concrete, of slump of concrete and of mixing time. Small deviation from proper amount will not increase or decrease amount of air to extent where it can do harm. It will not deteriorate or cake while standing.—*A. C. Horn Co., Inc., Long Island City, N. Y.*

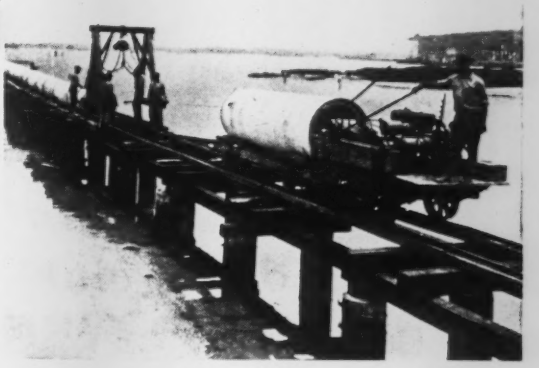
LOCK JOINT REPEAT PERFORMANCES



1943 – Installing 36" pipe alongside of old wood stave pipeline which it replaces.



1921 – Installation of Lock Joint pressure pipeline on Trestle over Elizabeth River.



10 JOBS SINCE 1920

AS NORFOLK GROWS so must its water supply system. For more than 25 years municipal engineers have met this City's continually increasing need for water by installing 73 miles of Lock Joint Reinforced Concrete Pressure Pipe. Thus a water supply system of sustained high carrying capacity, negligible maintenance cost, immense structural strength and unfailing service is assured for generations.

Repeat orders from Norfolk and many other American cities are convincing evidence of the complete dependability, high quality and economy of Lock Joint Reinforced Concrete Pressure Pipe.

For future projects, large or small, specify Lock Joint Pipe.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

Pressure Pipe Plant – Wharton, N. J. **Sewer Plant – Kenilworth, N. J.**

BRANCH OFFICES: Denver, Colo. • Chicago, Ill. • Kansas City, Mo. Rock Island, Ill. • Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio Hartford, Conn. • Navarre, Ohio

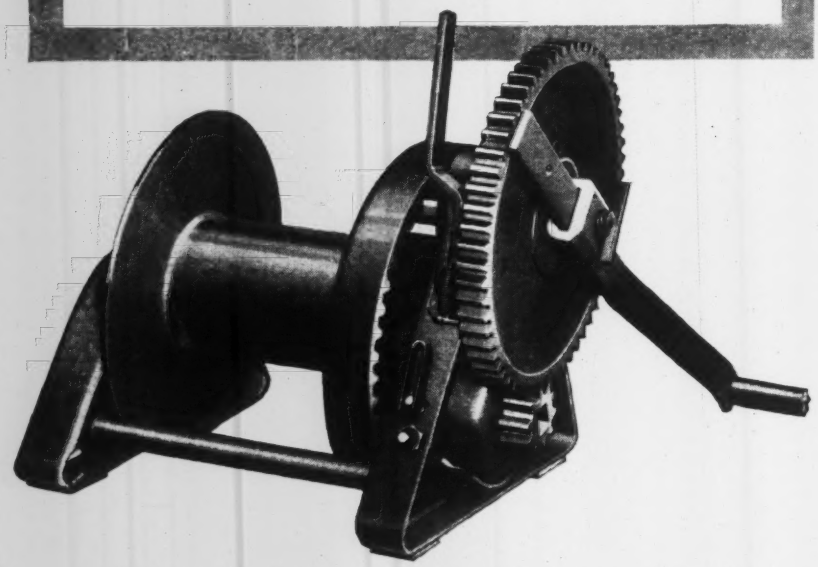
SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

HOW WOULD YOU DO IT?

Can one man, with no power equipment . . . | . . . unload this heavy, bulky cast iron pipe . . . | . . . and place it in a deep trench?



The job's a cinch . . . . with

HANDIWINCH

IT'S THE "little things" that bleed the profit out of any job, if they aren't handled efficiently. When you're lifting or pulling or moving loads up to 10,000 lbs., just plain "muscle power" is always slow and costly and often inadequate . . . yet heavy motorized hoists are far too expensive.

In such situations, the American Hoist HANDIWINCH is saving thousands of dollars for thousands of users daily. HANDIWINCH is *all steel* . . . built with many "big hoist" features. One man carries it, sets it up anywhere. It weighs 95 lbs., costs $75 f.o.b. your distributor. Write for folder HW-15, giving setup suggestions and full details on HANDIWINCH uses.

American Hoist

and DERRICK COMPANY

SAINT PAUL 1, MINNESOTA

713 *Plant No. 2,* South Kearny, New Jersey

CHICAGO • PITTSBURGH • SAN FRANCISCO • NEW ORLEANS • NEW YORK

LOCOMOTIVE CRANES • HOISTS • DITCHERS • DERRICKS • CANE CRANES • BLOCKS AND SHEAVES
MARINE DECK MACHINERY • CAR PULLERS • PILE DRIVERS • REVOLVER CRANES • CROSBY CLIPS

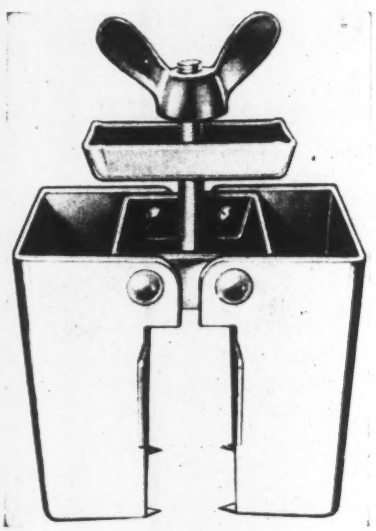
85

DUMP TRUCK — First pick-up size dump truck with completely automatic hydraulic cab control is designed for multiple uses in short hauls and small bulk handling. It is available either as complete unit with dump body or as kit

for conversion of almost all standard pick-ups into pick-up dumps. Included in kit are power pack hydraulic pump, hoist and subframe, hose and connecting parts, parts necessary to convert standard tailgate into double-acting tailgate, and body subframe. Of welded construction, dump body incorporates use of heavy-gage steel for sides, ends and bottom, which is supported by channels and angles.—*National Truck Equipment Co., Waukesha, Wis.*

86

SCAFFOLD BRACKET — Quick, economical method of making safe, strong scaffolds for all types of building construction is provided by Du-All 12-gage steel type brackets, which eliminate use



of bolts and nails. Scaffolds of any height can be easily made in 3 min. Pointed lugs in brackets, which weigh approximately 11 lb. per pair, prevent slipping.—*Du-All Scaffold Bracket Co., Columbus, Ohio.*

87

ELLIPSES—A set of 5 ellipses that cover almost every drafting and engineering need consists of 15, 30, 35, 45, and 60 deg. ellipses, and each template

(*Continued on page* 154)

10 MAJOR ADVANTAGES that mean higher production and lower yardage costs

MEASURE EACH JOB IN TERMS OF WOOLDRIDGE EQUIPMENT:

SCRAPERS
Tractor-drawn for handling heaping yardages from 6 to 28 cu. yards.

POWER CONTROL UNITS
Single and multiple drum with universal or roller fairleads.

BULLDOZERS
Tough and rugged design for standard makes of tractors.

TRAILBUILDERS
Adjustable angle blades for standard tractor mounting.

RIPPERS
Available in light, medium, and heavy duty models.

Point for point Wooldridge Terra-Cobras offer you greater yardage profits. When you put Terra-Cobras on your job you gain these outstanding Wooldridge performance features.

1. FIVE years of fully tested and proved performance under all types of operating conditions.
2. The original POSITIVE *HYDRAULIC* STEERING CONTROL.
3. Flexibly articulated oscillating pivot for easier, safer travel.
4. Smooth powerful air-controlled cable hoist.
5. Individual control of blade, apron, and positive tilt forced load ejector.
6. Balanced load distribution with maximum traction and power on drive wheel centers.
7. Greater maneuverability combined with shorter turning radius.
8. Ample power, acceleration and speed fully loaded.
9. Faster loading, dumping, and spreading.
10. All parts easily accessible for service maintenance.

Buy & Rely on

WOOLDRIDGE

TERRA COBRA

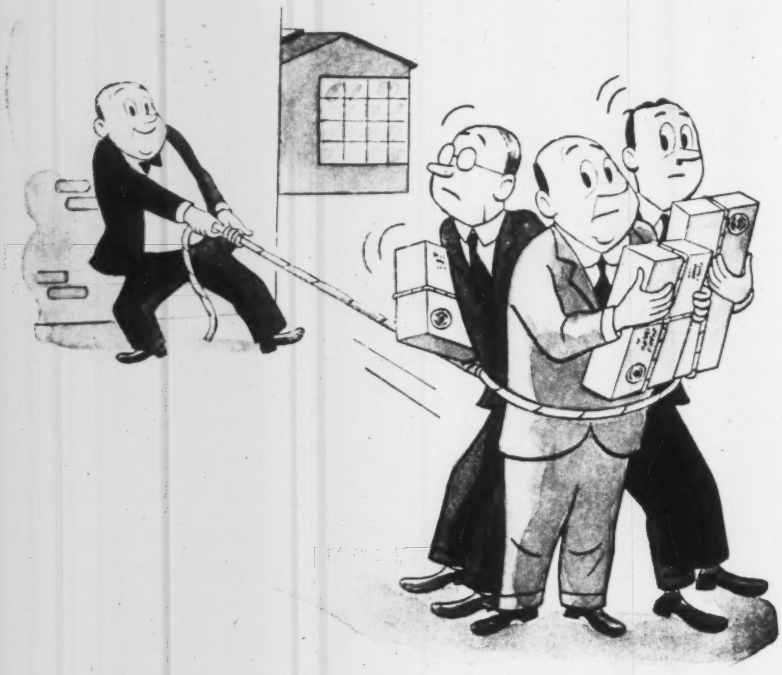
HIGH SPEED-SELF PROPELLED

EARTHMOVERS

WOOLDRIDGE MANUFACTURING CO.
SUNNYVALE, CALIFORNIA

NATIONWIDE SERVICE

How to keep your supply sources right at hand!



With Air Express cutting delivery time from any U. S. point to a matter of hours, it's like lassoing your supply sources and keeping them within quick reach.

You get the fastest possible service with Air Express. Special pick-up and delivery service is included. And since Air Express goes on *every* flight of the Scheduled Airlines, shipments keep moving — *fast*. If you're faced with overseas shipping problems, Air Express can save you *weeks* of delivery time. Use this speedy, inexpensive service regularly.

Specify Air Express-it's Good Business

• Low rates — special pick-up and delivery in principal U. S. towns and cities at no extra cost. • Moves on all flights of all Scheduled Airlines. • Air-rail between 22,000 off-airline offices. • Direct air service to and from scores of foreign countries.

Just phone your local Air Express Division, Railway Express Agency, for fast shipping action . . . Write today for Schedule of Domestic and International Rates. Address Air Express, 230 Park Ave., New York 17. Or ask for it at any Airline or Railway Express Office.

AIR EXPRESS

AIR EXPRESS GETS THERE FIRST

Fastest delivery — at low rates

Memphis, Tenn. manufacturer requested fast delivery of spare parts (34 lbs.) located in San Angelo, Tex. Picked up 11:50 AM the 21st, delivered same day at 5:40 PM. 668 miles, Air Express charge $7.31. Other weights, any distance, similarly inexpensive and *fast*.

AIR EXPRESS DIVISION, RAILWAY EXPRESS AGENCY . . . A SERVICE OF

THE SCHEDULED **AIRLINES** OF THE UNITED STATES

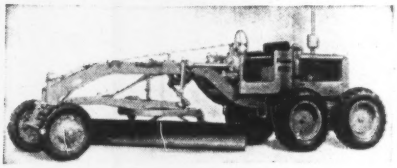
permits the drawing of any ellipse from 1/4 to 12 in. in dia. Each has a proportional scale to check the proper degree template to use when the major and minor diameters are known.—*The 4-Thru Ruler Co., 827 Windsor St., Hartford, Conn.*

88

WATER CARRIER — New portable water carrier is made of stainless steel and is well-insulated to keep water cool for many hours in field. It has recessed faucet that turns off automatically when released. Lug is provided for single or double unit Vortex paper cup dispenser. Double unit dispenser has receptacle for used cups. Capacity is approximately 4 gal.; size 18 in. high, 15 in. long, 8 in. wide. Two adjustable carrying straps are provided.—*Dixie Cup Co. Easton, Pa.*

89

MOTOR GRADER—New diesel No. 212 features 45-hp. maximum output, increases in all of its four forward speeds, power-operated mechanical controls equipped with effective brakes, which prevent creeping or coasting under load; arched front axles which provide maximum clearance; and manufacturing improvements resulting from use of new, harder metals and better heat treatment. Its power increase is developed by new D311 engine, with bore increase from 3 3/4 in. to 4 in., chrome plated top piston rings; divided manifolding, new fuel injection valve and other features. Also announced is new D2 tractor, which develops maximum 32 drawbar horsepower.—*Caterpillar Tractor Co., Peoria 8, Ill.*



(*Continued on page* 158)

Ingersoll-Rand

MOBIL-AIR

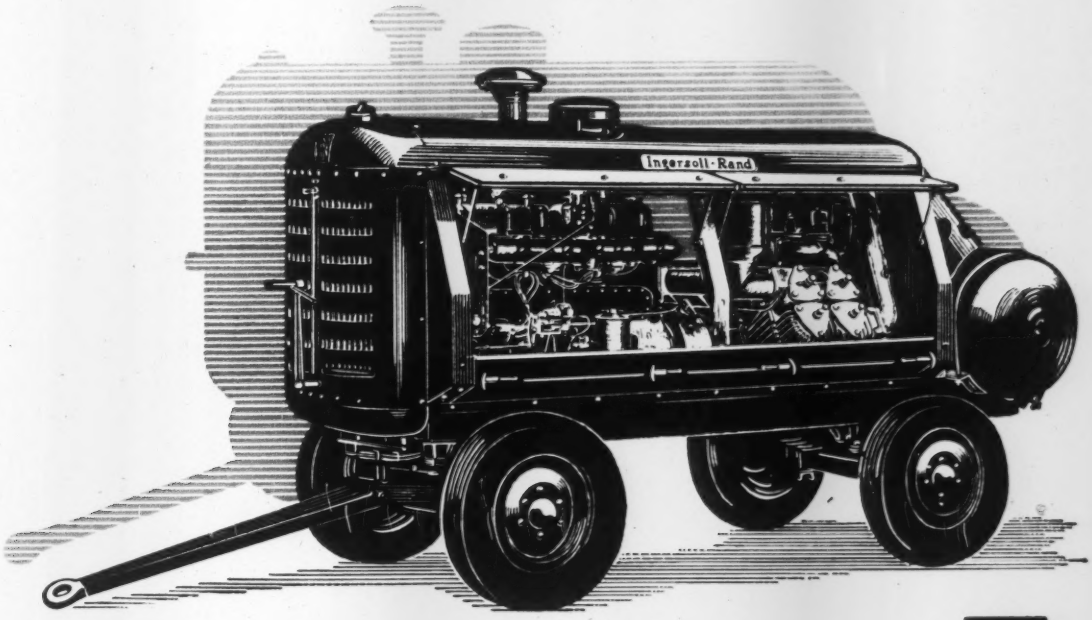
AIR POWER

for men who demand Quality in a Portable Compressor

A MOBIL-AIR Compressor gives you the same smoothness and reserve of power, the same beauty of a job well done, the same fitness to do its job, and the same ruggedness and stamina that you demand in every top-quality machine.

Perhaps you have always used Ingersoll-Rand portable compressors, or you may always have wanted one. It's natural for men to desire possession of the finest machines, and to want to work with them.

If you are not able to get the size MOBIL-AIR Compressor you need when you need it, you may find it worth waiting for . . . one of the new KA-Series MOBIL-AIR equipped with the Drill-More Regulator.



Ingersoll-Rand

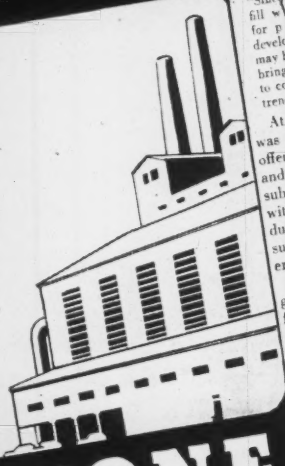
11 BROADWAY, NEW YORK 4, N. Y. 152-2

COMPRESSORS • AIR TOOLS
ROCK DRILLS • TURBO BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS
OIL AND GAS ENGINES

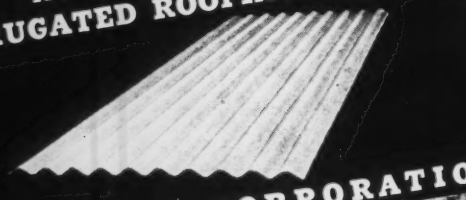
NOW AVAILABLE!

If it's heavy-duty construction specify **ASBESTONE**

FIREPROOF
NONCORROSIVE
CLIMATE-PROOF
INSULATING
RATPROOF
NO UPKEEP
NEVER WEARS OUT



ASBESTONE
ASBESTOS-CEMENT
CORRUGATED ROOFING & SIDING



ASBESTONE CORPORATION

A few of the many industrial leaders who have built with ASBESTONE:

LONE STAR CEMENT CORP.
CALIFORNIA OIL CO.
FREEPORT SULPHUR CO.
NEW ORLEANS PUBLIC SERVICE
MOBILE PAPER MILL CO.
CROSBY CHEMICALS

Asbestone production has been concentrated on Corrugated to assure prompt delivery for industrial construction. Free Engineering Service, available on request; shows how Asbestone can be adapted to your needs.

ASBESTONE CORPORATION
Specialists in Asbestos-Cement Building Products for Over 25 Years
8300 TCHOUPITOULAS STREET NEW ORLEANS 18, LA.

90

HOIST—Lad-E-Vator has two aluminum ladder-like tracks that hold the four wheels of its loading platform. These tracks come in 12 to 25-ft. units. At their upper end, they curve over

to deliver load inside working area. Hoist can be assembled and taken down quickly. It handles 500-lb. loads and travels up to 80 ft. per min. When two sections of track are used they are extensible to height desired. Platform stays level all the way to top.—*Campbell Equipment Co., 664 Ridge Ave., Chicago, Ill.*

91

TRACTOR ATTACHMENT—Hystaway attachment, previously used on D6 and D7 Caterpillar track-type tractors, is now available for D8 model. Specifications now call for ½-cu. yd. bucket

on D7 and D8 with ⅜-cu. yd. bucket on D6. Basic unit is now made for any of three models, with an attachment group for specific model. Attachment groups are also made for fitting unit to wide gage tractors and to those with additional attachments.—*Hyster Co., Portland 8, Ore.*

Manufacturers' Publications

92

Herringbone Gear Reducers—(68-p. book) Gives detailed descriptions of many new sizes and types of enclosed herringbone gear units for speed reducing and speed increasing service. Engineering information includes reducer selection data and examples of proper application; dimensions and horsepower ratings; lubrication data; and tables of maximum allowable pull on high and low speed shafts.—*Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill.*

93

A.C. Motor—(4-p. bulletin) Describes Adjusto-Spede, variable speed a.c. motor which is suited for driving conveyors and other variable speed machines requiring constant torque input throughout operating speed range. —*Louis Allis Co., 427 E. Stewart St., Milwaukee 7, Wis.*

94

Power Units—(New catalog) Provides up-to-date knowledge of complete line of gasoline and diesel engines and power units now available in range of from 4 to 400 hp. Pertinent information is given to assistant power user in choosing most suitable power for particular application.—*Hercules Motor Corp., Canton, Ohio.*

95

Torque Wrenches—(4-p. catalog) Lists six models of torque indicators (tension wrenches) with capacities ranging from 50 ft.-lb. to 1000 ft.-lb. Also available is 36-p. socket wrench catalog.—*Blackhawk Mfg. Co., Milwaukee 1, Wis.*

96

Lift Truck Guide—(28-p. booklet, pocket size) Simplifies selection of correct fork lift truck, industrial tractor or fork truck accessory for any materials handling job.—*Towmotor Corp., 1226 E. 152nd St., Cleveland 10, Ohio.*

97

Sand Dewatering Device—(4-p. folder) Describes and illustrates dewatering rotoscoop, giving dimensions, capacities, horsepower required and weights. Device is capable of recovering available sand grains, of sufficient fineness to meet specifications, and discharging product dry enough to permit truck transportation or mechanical conveying to and from storage.—*Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill.*

98

Floor Tile—(4-p. folder) Describes Plastile, new laminated vinyl floor tile, made from tough Tygon plastic, which can be laid with ordinary linoleum cement.—*United States Stoneware Co., Akron 9, Ohio.*

99

Elevator Belting—(Descriptive folder) Stresses fact that Maltese Cross elevator belting has set numerous tonnage records for low-cost materials handling. Constructed of tough rubber compounds securely bonded to first quality, high-tensile cotton carcass, this belting is supplied in both standard and shock-pad construction.—*Hewitt Rubber Division, Hewitt-Robins, Inc., Buffalo 5, N. Y.*

100

Rubber Products—(New bulletin) Describes products for all phases of marine industry, including shipbuilding and repair, loading and unloading, shipboard maintenance and harbor construction. It covers air and deck hose, dredging sleeves, sand suction, pile driving, welding hose, conveyor and V-belts.—*Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J.*

101

Ten-Horsepower Engine—(20-p. booklet) Describes "CK" engine in action and includes many photographs and illustrations of unit in use. Mass production of engine, from foundry to shipping room is described.—*D. W. Onan & Sons, Inc., Minneapolis 5, Minn.*

102

Construction Equipment—(48-p. bulletin) Provides illustrated case histories to show how various manufacturers have successfully used Amsco manganese steel castings at points of impact or abrasion on their equipment. Data and photographs cover dippers; crusher parts, chain; ditcher, tractor, loader, bulldozer and scarifier parts; asphalt and concrete mixer parts; wire rope sheaves, welding products; Amsco-Nagle material handling pumps; and dredge pumps.—*American Manganese Steel Division, American Brake Shoe Co., Chicago Heights, Ill.*

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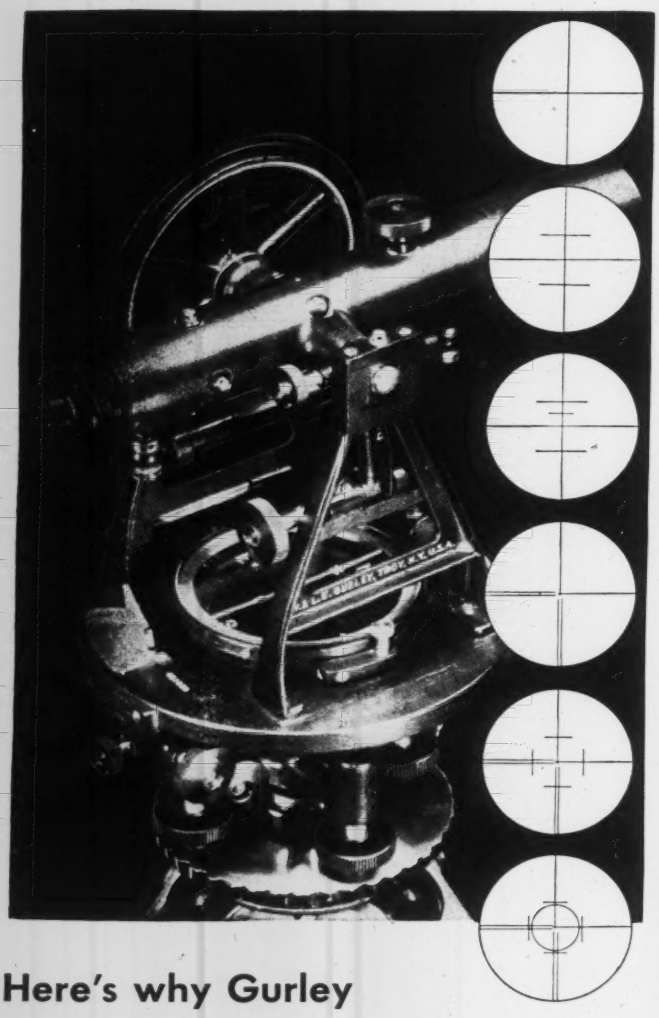

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Men and Jobs

Maurice Maskrey has been chosen president of the Clay Sewer Pipe Association, Columbus, Ohio, taking the place left vacant since the death of H. C. Maurer. He studied sewerage engineering at Ohio Northern University. For many years he was connected with the rubber industry. **Benjamin Eisner** continues as chief engineer of the association.

Charles H. Williams, who served for 18 years as city engineer and water superintendent and for the last year as water superintendent alone at Olympia, Wash., has resigned. **H. G. Porak** succeeded Williams as city engineer several months ago. A successor as water superintendent has not yet been chosen.

Grady W. Lyons has been made city engineer of Gainesville, Tex.

J. Mack Jones, former city engineer of Coolidge, Tex., has taken office as county engineer for Limestone County.

Appointments announced by the Pennsylvania State Highway Department include **John W. King,** Porter Township, as project engineer in District 9 with headquarters at Hollidaysburg, and **Horace S. Miller,** of Washington, Pa., as project engineer in District 10, with headquarters at Uniontown.

R. L. Cochran, former state engineer of Nebraska and deputy chief of the American Aid Mission to Greece, has left Athens to resume his post as chief of the public works section of the budget bureau in Washington.

Robert S. Taggart has taken a position in New York City as assistant sanitary engineer of the National Biscuit Co. He has been district engineer for the New York State Department of Health at Amsterdam for the last 11 years with intervening service in the Sanitary Corps, with duty at Camp Edwards, the Surgeon General's Office, and Headquarters, Second Service Command.

Robert E. Pierce, engineer with the California highway division's planning survey, retired recently after more than

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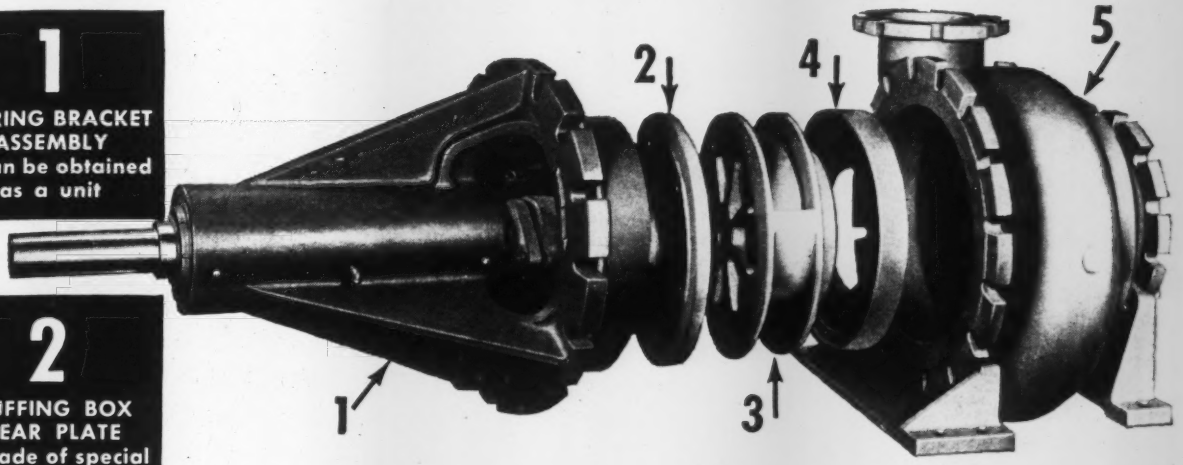

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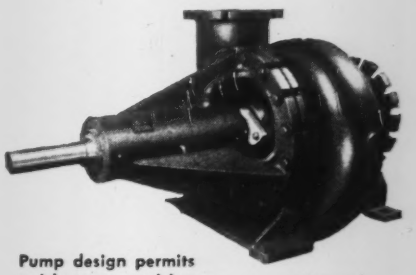

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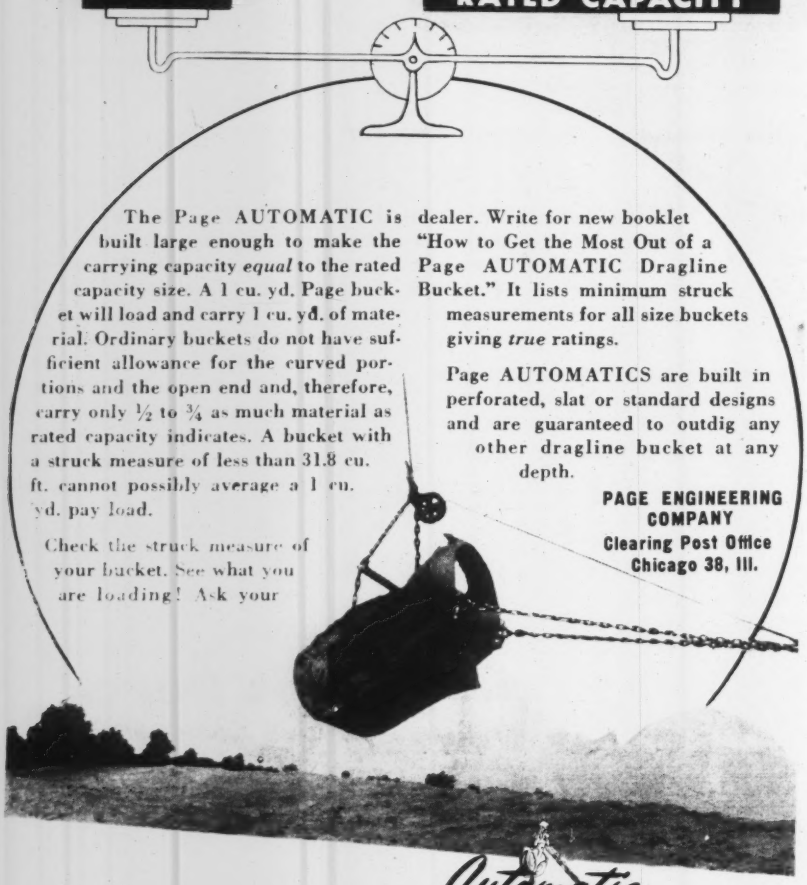

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32 years of work with the state agency. He began his career as assistant resident engineer on the Yolo Causeway at Davis, Calif., holding various engineering positions until he was appointed district engineer of District X in March 1926. He held that post until 1942, when he was transferred to headquarters in Sacramento and to the planning project.

Melvin J. Berscoter, Murrayville, Ill., has been named acting superintendent of highways of Morgan County, Ill., with headquarters in Jacksonville, Ill., to succeed the late Charles H. Harney.

Robert S. Crane has resigned as Greene County, Ohio, engineer at Xenia, to enter private business in Tampa, Fla.

Frank L. Holland has become county engineer of Orange County, Fla., at Orlando. He will also serve as superintendent of the county's road and bridge department.

William A. D. Wurts, assistant city engineer of Hartford, Conn., has been appointed manager of the Metropolitan District Commission of that city. He becomes manager of both the water bureau and the bureau of public works when the present heads resign from these posts and become consulting engineers of these departments. City Engineer Robert J. Ross is at present head of the Bureau of Public Works and Caleb M. Saville manager of the Water Bureau. The appointment is in line with a reorganization plan proposed in September by Commission Chairman Charles A. Goodwin. The complete reorganization program is expected to become effective by 1948. Mr. Wurts is a graduate of Rensselaer Polytechnic Institute where he taught civil engineering. He joined the Hartford city engineering department in 1925.

William A. Carver, formerly civil engineer, air installation, San Bernardino, Calif., Army airfield, air materiel area, has become assistant civil engineer, with the division of water resources, Department of Public Works, Sacramento, Calif. He is now working on the Sutter-Yuba County ground water investigation.

W. S. Byrne has been appointed construction engineer on the newly-authorized Bonny Dam to be constructed near Hale, Colo. Headquarters and housing units for the job will be established in St. Francis, Kan. Bonny Dam will be an earth dam across the

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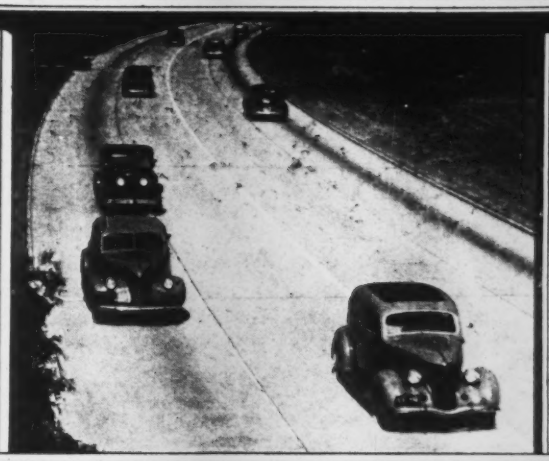

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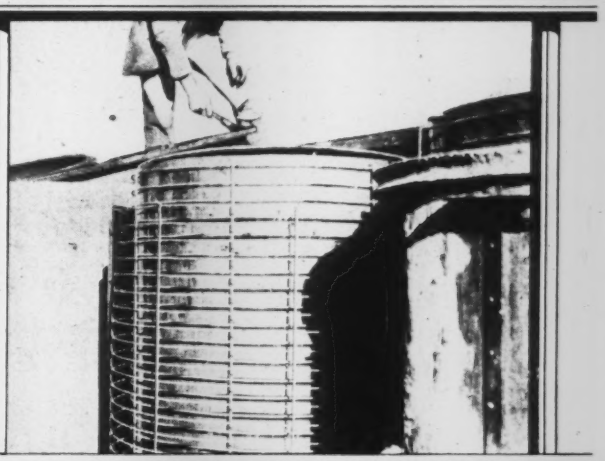

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South Fork of the Republican River about 25 miles up stream from St. Francis and is part of the integrated flood control work in the Republican Valley and Missouri Basin. Until transferred to Bonny Dam, Mr. Byrne was on the W. C. Austin (formerly Altus) Project at Altus, Okla. His transfer ended a tenure of 7½ years at Altus during which he served as field engineer, assistant construction engineer and construction engineer. From 1932 until 1940 he was in the office of the Chief Engineer in Denver, Colo.

Edwin F. Wanner has become chief engineer of the National Fireproofing Corp., in Pittsburgh, Pa. He was on leave of absence through the war, working on a number of important masonry engineering projects at the Washington, D. C., headquarters of the Structural Clay Products Institute. He will continue the work on these projects. He joined SCPI in February, 1942. He also served as a research associate at the National Bureau of Standards. With H. C. Plummer, he was co-author of the textbook, "Tile Engineering." He also collaborated with Mr. Plummer on the handbook, "Recommended Mortar for Clay Products Masonry," and prepared alone a number of papers on modular-designed and reinforced masonry. He was graduated from the University of Pittsburgh, 1929, and took further study in design at Carnegie Tech.

Dan W. Kothe, assistant in the city engineering department at Elyria, Ohio, has been appointed that city's next safety-service director, to succeed I. D. Faxon, resigned.

James K. Searcy has been transferred by the water resources branch of the U. S. Geological Survey from office engineer of the Jackson, Miss., district to office engineer of the Rolla, Mo., district, which is investigating surface water resources of Missouri in cooperation with the Missouri Geological Survey and various U. S. Engineer offices. Mr. Searcy is a 1931 graduate of Georgia Tech and was employed by the Georgia State Highway Department and later by the U. S. Engineer office at Vicksburg, Miss. He joined the U. S. Geological Survey in 1935. He had almost 5 years of Army service with last active rank of major in the Coast Artillery Corps.

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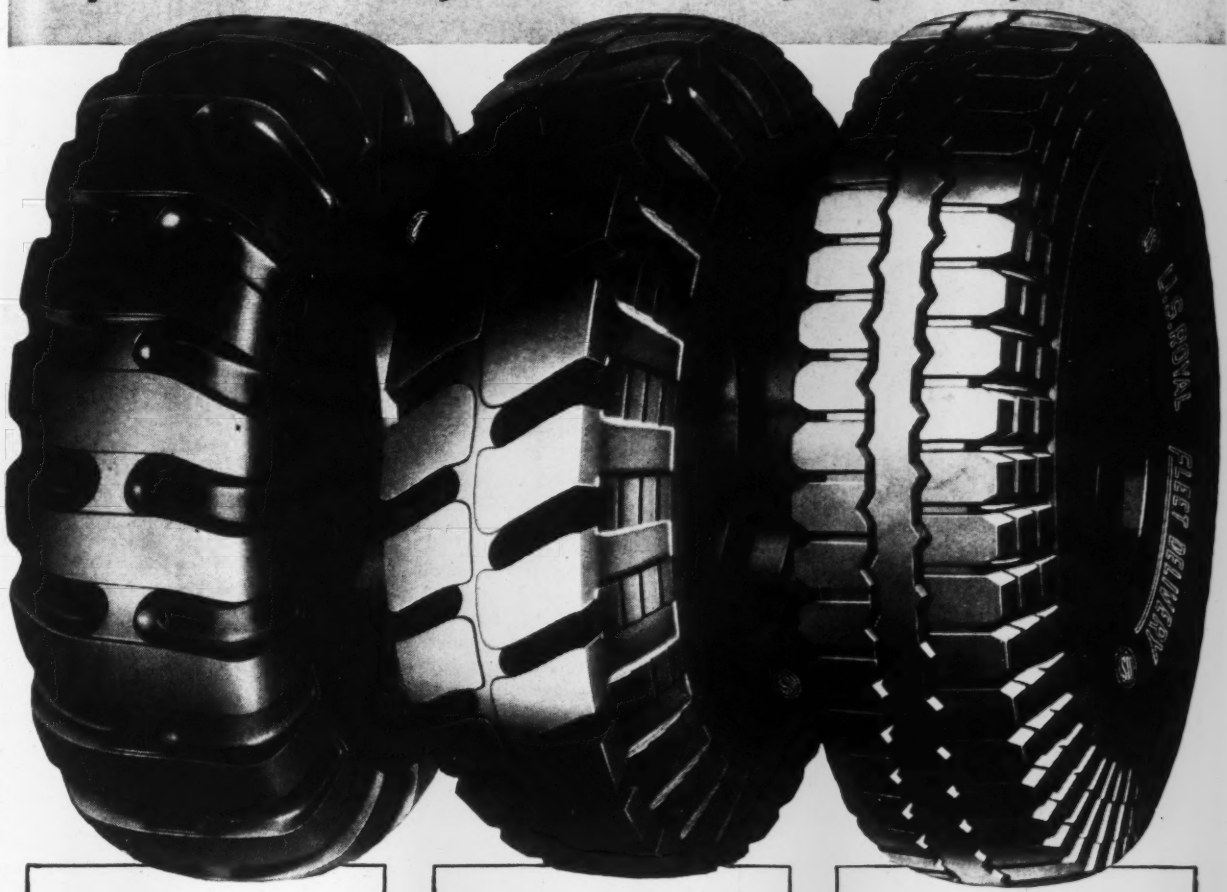

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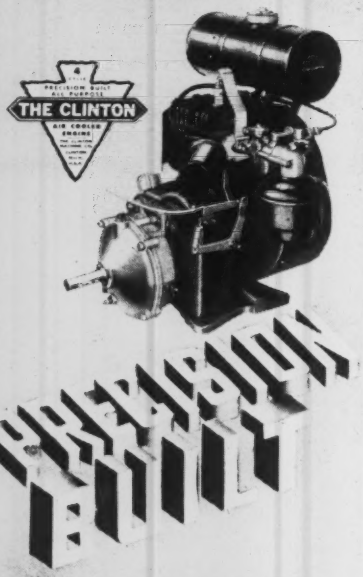

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Elections and Activities

The North Carolina Section of the American Society of Civil Engineers and the N. C. State College student section held a joint meeting at Raleigh, N. C., Oct. 31 which was attended by over 200 engineers and engineering students from all parts of the state. Some 40 students of the Duke University Engineering School were guests.

Principal speaker was Kenneth L. Coltrin of Norfolk, Va., chief of the flood control branch of the Army's Corps of Engineers, who described the Buggs Island flood control and hydroelectric project on the Roanoke River. Other speakers included: B. P. McWhorter of Atlanta, Ga., division engineer of the Public Roads Administration; and John D. Watson of Greensboro, N. C., program chairman of the N. C. Section. Student papers were presented by J. R. Armstrong, Jr., of Jamestown, N. C., member of the N. C. State College student section, and C. H. Kahn of Concord, N. C., member of the college section group which made a traffic survey at Raleigh recently.

G. H. Richards, city engineer of Brantford, Ont., has been elected president of the Canadian Institute of Sewage and Sanitation.

Nine counties are represented in the new Northeast Texas Chapter of Texas Society of Professional Engineers. Its charter was presented recently by T. C. Forrest, Jr. of Dallas, national director from the Texas society. Officers of the new chapter are J. R. Cravens of Paris, president, E. F. Crow of Paris, secretary; B. L. Deberry of Emory, W. B. Holmes of Greenville, Glen Fry of Sulphur Springs, F. M. Davis and W. F. Hicks of Paris, directors.

The Mid-South Section of the American Society of Civil Engineers, representing the states of Mississippi, Arkansas and Tennessee, will meet in Jackson, Miss., Dec. 5-6. Garner W. Miller of Memphis, Tenn., is president. Norman Moore, of Vicksburg, Miss., has been named general chairman of the executive committee which includes H. G. Dewey, Jr., Irving E. Anderson, H. H. Lester, G. W. Heard and C. V. Maxwell, Jr., all of Jackson, Miss. Other officers of the organization, in addition to the president are John Strom, vice-president, Little Rock, Ark.; H. W. Dougherty, secretary-treasurer, Memphis, Tenn.; W. J. Turnbull, director, Vicksburg, Miss.; I. G. Norton,

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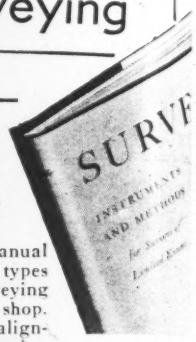

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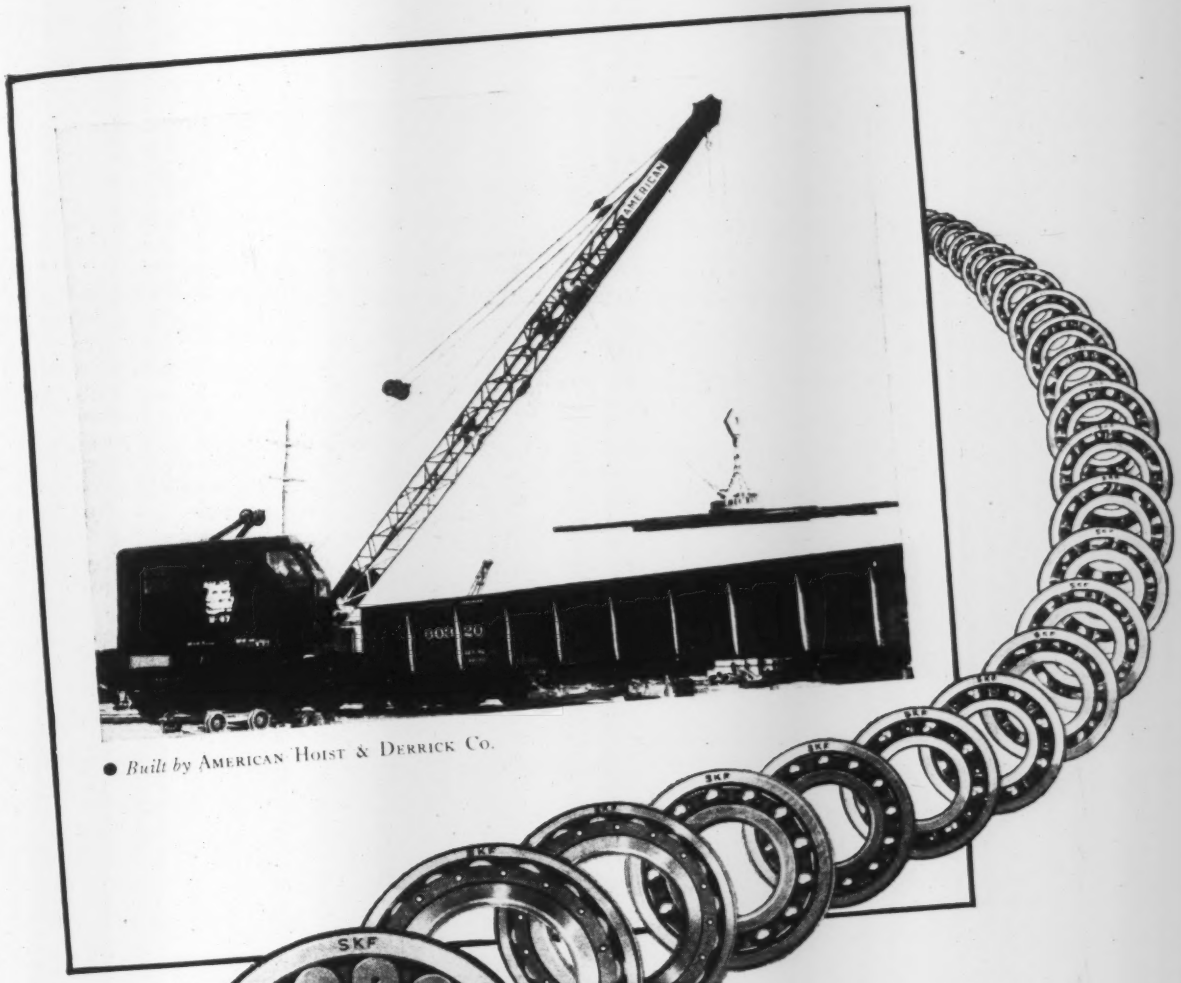

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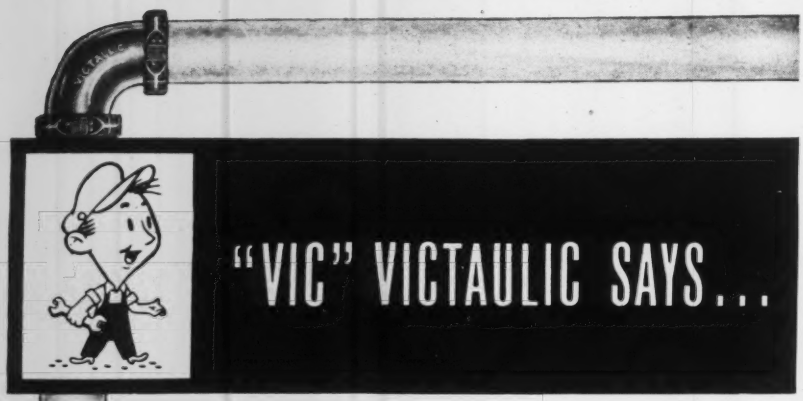

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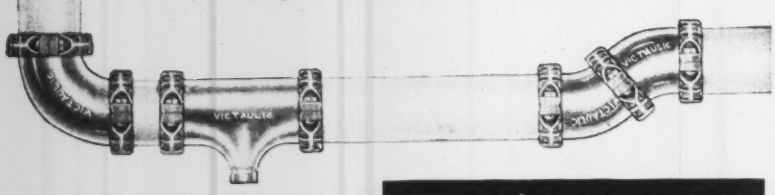

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director, Memphis, Tenn.; S. K. Jackson, director, Fort Smith, Ark.; R. W. Sauer, director, Vicksburg, Miss.

Tom J. Skinker, commissioner of the St. Louis, Mo., water board, has been elected president of the Missouri Society of Professional Engineers. He succeeds C. G. Rath, Westinghouse Electric and Manufacturing Co., Kansas City. R. E. Riddle, St. Joseph, was elected first vice-president; R. Y. Jones, Neosha, second vice-president, and Harold J. Bruegging, Jefferson City, re-elected secretary and treasurer.

W. R. Wise, engineer and assistant superintendent of the Newberry, S. C. waterworks has been elected chairman of the Southeastern section of the American Waterworks Association. T. A. Jones, superintendent of the Water, Light and Sewage commission was made vice-chairman. Sherman Russell, Atlanta, was elected trustee for Georgia.

Raymond F. Lund, Rapid City, has been elected president of the South Dakota Reclamation Association, succeeding W. W. Morrison, Mobridge. Other officers elected were Philip Vallery, Fruitdale, vice-president, and Irvin Krumm, Huron, secretary-treasurer. William Scott, Sioux Falls, was named national director.

New officers elected by the South Dakota County Commissioners are: Frank Telcamp, Brookings, president; Howard E. Trask, Pierre, vice-president; L. E. Larson, Baltic, secretary-treasurer.

Officers elected by the County Highway Association of South Dakota are: Clarence Stephens, Rapid City, president; Earle Hollaway, Brookings, vice-president; Ed Bower, Faulkton, secretary-treasurer.

J. P. Exum, a Texas State Highway Department engineer, is the new president of American Society of Civil Engineers' Texas section. He succeeds Conrad Blucher of Corpus Christi, who will remain as a director. Mason Lockwood of Houston and J. K. Alewine of Fort Worth were chosen vice-presidents and J. W. Santry of Dallas, secretary. These officers, Blucher and H. R. F. Helland of San Antonio constitute the board of directors.

James K. Peden, president of a Raleigh, N. C., steel company, and C. L. Barnhardt, city engineer, have been elected chairman and secretary, respectively, of a new city zoning commission which has just been named at Raleigh.

Big Yardage + More Loads = Real Paydirt

That's the sure-fire formula for transforming earth and rock into real pay dirt.

And that's the way Mack super-duty trucks are built to operate. On the toughest off-highway dump work Macks have consistently demonstrated their ability to move bigger yardage per load and more loads per hour.

They've got power in abundance! Extra margins of strength and stamina! Assured traction through Mack's exclusive Power Divider for both four and six-wheel trucks. And throughout their design special stress has been placed on ease of control, maneuverability and clear vision — thus reducing shovel delays to a minimum.

Mack trucks for off-highway service range up to the largest capacities built — gasoline or diesel — four or six wheels. Each is individually engineered for its specific job and each takes to its job only after thorough study of the proposed operation.

Our engineers will gladly advise you on the most efficient use of trucks on your particular excavation job.

Write or call your nearest Mack branch or dealer.

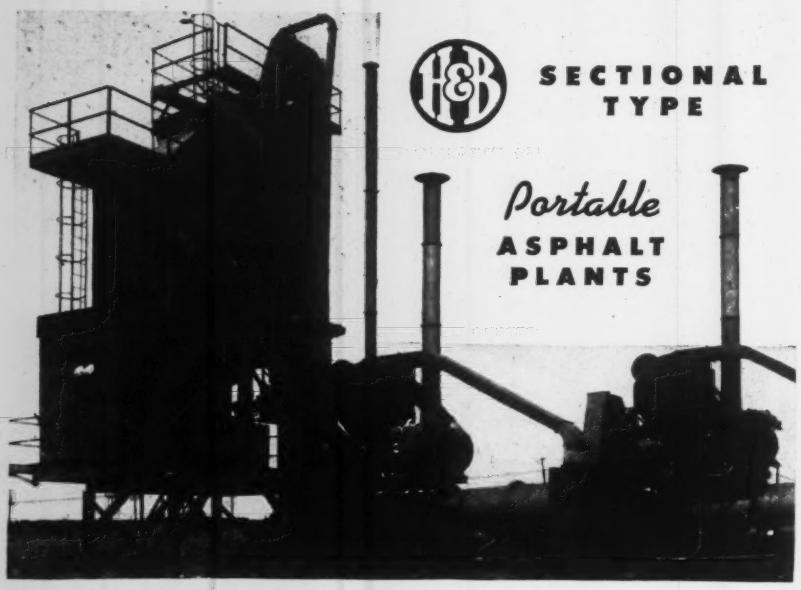
Mack

since 1900, America's hardest-working truck

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts. In Canada, Mack Trucks of Canada, Ltd.

Trucks for every purpose.

6192



H&B SECTIONAL TYPE

Portable ASPHALT PLANTS

For Dependable, Uniform and Economical Production

The MOTO-PAVER

The complete traveling mixer and paver. A self-contained single unit machine which accomplishes the entire mixing and laying job in one continuous operation. Write for Bulletin MP-47.

First to build the sectional type asphalt plant, Hetherington & Berner, Inc., has always striven to build machinery which would give uniformly dependable production over a period of years. The record of H & B plants under all kinds of operating conditions is the best answer as to how well we have succeeded.

H & B sectional type plants are built in two general models: Model PE electrically-driven plants, recommended primarily for contractors who do not ordinarily move more than once or twice a season; Model PA plants, designed primarily for the contractor who moves frequently and who must be able to get efficient production on small as well as large jobs, and under a wide variety of operating conditions.

Bulletin P-46, describing both PE and PA plants, will be sent on request.

HETHERINGTON & BERNER INC.

730 KENTUCKY AVE. • INDIANAPOLIS 7, IND.

America's First Builder of Asphalt Mixing Equipment

PREHY GROUTERS— WEBER SYSTEM

New indispensable Equipment for Contractors, Railroads, Mines and all public and private Construction Departments.

Plastic and Fluid Pressure Grouting, Pneumatic Concrete Construction, Railway Track and Soil Stabilization, Correction of Structural Deficiencies, Subsiding Foundations, Floors, Drypack Concrete and many other practical uses.

Write for complete information

The Prehy Co., Inc. 420 LEXINGTON AVE NEW YORK 17, U.S.A.

Manufacturers' Activities

Current developments among manufacturers relating to expansion of services, shifts in personnel, and other changes, include the following:

Sales Staff Changes—Austin F. McCormack has been named sales engineer in charge of the newly established Rochester office of the PERMUTIT CO. . . . BLAW-KNOX CO. has appointed Cornelius L. Sarosdy sales engineer in Texas, Oklahoma and New Mexico. . . . Truman A. Dunn will represent the PIONEER ENGINEERING WORKS, INC., in Kentucky, West Virginia, Ohio, Indiana, lower Michigan and northern Illinois. . . . THE ALLIS-CHALMERS CO. has announced organization of a fifth region to cover New York, Buffalo, Rochester, Syracuse, N. Y. and Newark, N. J., under Arch J. Cooper, New York district office manager. . . . J. C. Elmburg, formerly manager at Boston, is now in charge of the Atlanta, Ga., branch house for FAIRBANKS-MORSE CO. . . . Harold J. Fikejs is manager of the MACK TRUCK CO.'s Milwaukee, Wis., direct factory branch. . . . THE KALMAN FLOOR CO. has announced the transfer of F. W. Hill of the Cleveland office to become district manager of the West Coast district at Los Angeles. . . . Edmund Greene has been appointed sales promotion and advertising manager of the Merrimac Division of the MONSANTO CHEMICAL CO. . . . SECURITY VALVE CO. of Los Angeles has appointed Samuel H. Skofield of San Francisco sales representative for the company's valves. . . . THE LINK-BELT CO. has opened its own sales office in Grand Rapids, Mich., under direction of Peter Groustra, formerly district sales engineer at Detroit. . . . D. A. Hutchison, formerly district sales engineer for Illinois, Wisconsin and Indiana for the STERLING TOOL PRODUCTS CO., is now assistant sales manager for the company.

Dealer Appointments—INDUSTRIAL SUPPLY CO. of Minneapolis is now distributor for the entire Hewitt Rubber Division's line. . . . THE DAVEY COMPRESSOR CO. has appointed J. S. LARKIN CO. of Harrisburg, Pa., as distributor there. . . . CAPITAL EQUIPMENT, INC., of Troy, N. Y., is now representative for the BARBER-GREENE CO. . . . THE ST. LOUIS RAILWAY SUPPLY CO. of St. Louis, Mo., has been named distributor of Robins Conveyors Division equip-

FOR MATERIALS HANDLING ECONOMY

Specify Conveyor Belts

FOR 6 TIMES THE HAUL AND LIFT

Specify Steelply Reinforced

It takes conveyor belting to keep heavy bulk materials flowing efficiently, continuously, at low cost. Now, thanks to the use of Roebling Steelply cord, conveyor belts of far greater strength can be made . . . to handle your toughest loads even more economically.

With Steelply reinforced conveyor belts the haul and lift of conventionally designed belting are radically increased . . . multiplied sixfold! That means fewer belt transfer points on long-center, high-lift installations . . . heavier loadings at the same speed . . . or the same output at lower speed. You save on power and equipment costs.

There's plenty of lateral flexibility in conveyor belts reinforced with Steelply cord to make for proper troughing—and just the required longitudinal stiffness to stop undue sagging between idlers.

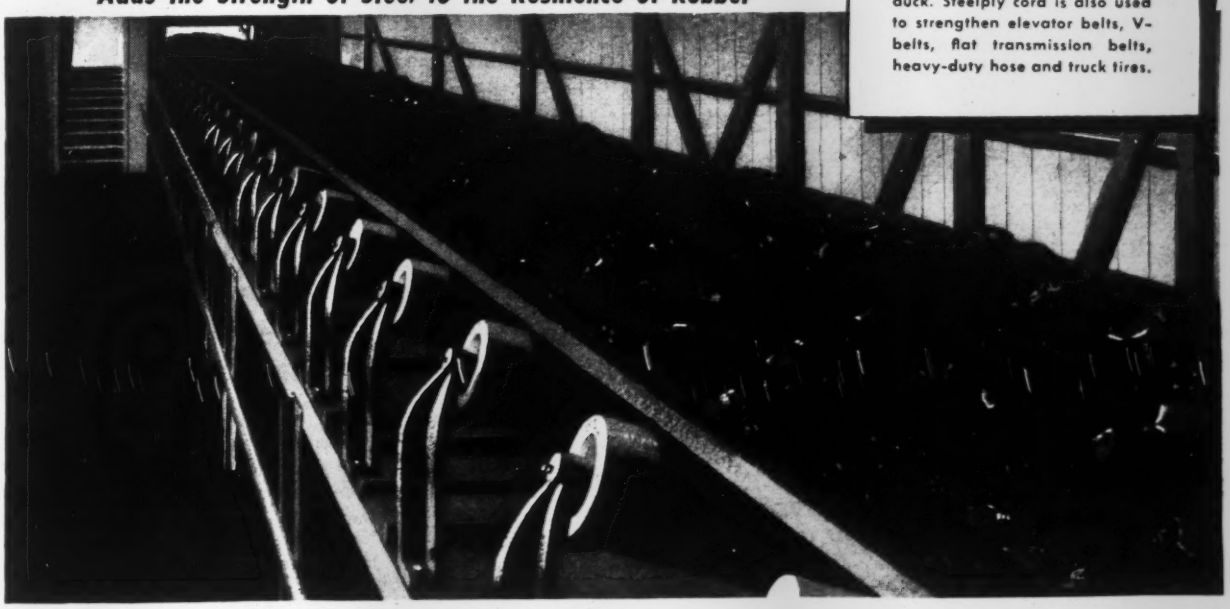
It's worth your while to check the savings you can get from conveyor belts strengthened with Roebling Steelply cord. Ask your regular supplier for the facts when it's time to replace your present belts.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

Adds the Strength of Steel to the Resilience of Rubber

WHAT IS STEELPLY?

Roebling Steelply cord is the load-carrying core in a revolutionary new kind of conveyor belting. It consists of small-diameter steel cables . . . finely stranded, extremely flexible, practically stretchless . . . encased in sturdy, rubber-impregnated duck. Steelply cord is also used to strengthen elevator belts, V-belts, flat transmission belts, heavy-duty hose and truck tires.



ROEBLING

A CENTURY OF CONFIDENCE

only **KINNEY**
BITUMINOUS DISTRIBUTORS
have this famous KINNEY PUMP

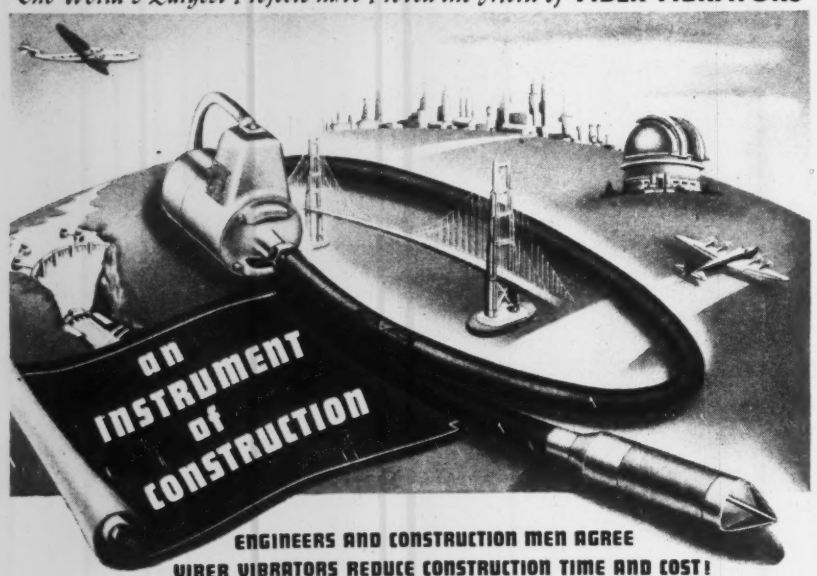
KINNEY SD Rotating Plunger Pump. Bolts directly to tank outlet. Capacity 405 G.P.M.

The KINNEY Rotating Plunger Pump is the heart of the KINNEY Distributor . . . its high capacity makes loading faster, speeds up application and permits fast road speeds. The pump jacket, connected to the truck exhaust, heats material left in the pump, for easy starting. The pump is accurate as a meter—the KINNEY Distributor will apply tar, asphalt, road oil, cut-back and emulsions in the exact amount specified by the highway engineers. The KINNEY Distributor is recognized as a top performer in all parts of the world.

Write for Bulletin.

KINNEY MANUFACTURING COMPANY
3527 WASHINGTON STREET, BOSTON 30, MASS.
New York • Chicago • Philadelphia • Los Angeles • San Francisco
We also manufacture Vacuum Pumps, Liquid Pumps and Clutches

The World's Largest Projects have Proved the Merit of **VIBER VIBRATORS**



ENGINEERS AND CONSTRUCTION MEN AGREE
VIBER VIBRATORS REDUCE CONSTRUCTION TIME AND COST!

To obtain maximum density and strength in concrete, it is important that the entire mix be given internal high speed vibration. This reduces voids, honeycombs, shrinking and cracking, also placing and compaction time. Built to withstand the strain on heavy construction jobs, the VIBER Vibrator makes practical the use of drier mixes. The interchangeability of VIBER units permits quick conversion to changing job conditions, eliminating delays, and the light weight portability offers easy one-man operation.

Important facts and specifications on VIBER Vibrators furnished upon request.

VIBER COMPANY EST. 1931
ORIGINATORS OF INTERNAL CONCRETE VIBRATION
725 S. Flower, Burbank, Calif.

ment. . . . The Dumpcrete division of the MAXON CONSTRUCTION CO. has appointed the ANDERSON EQUIPMENT CO. at Omaha, Neb., as distributors for Nebraska. . . . HOOPER ENGINEERING Co. of Skaneateles, N. Y., has been appointed representative in central New York for the BARBER-GREENE construction and Industrial divisions. . . . J. W. BARTHOLOW MACHINERY Co. of Dallas, Tex., has been appointed representative for its area for the GORMAN-RUPP Co. . . . New distributors recently appointed by the ALL STATE WELDING ALLOYS Co. include the DENVER OXYGEN Co. of Denver, Colo. . . . THE AIR REDUCTION SALES Co. has opened a new retail store in Des Moines, Iowa. . . . NORMAN EQUIPMENT Co., a California corporation, recently purchased the business previously conducted as COAST EQUIPMENT Co., San Francisco.

Plant Expansions — THE SYNTRON Co. of Homer City, Pa., has purchased the former H. K. PORTER Co.'s shell plant at Blairsville, Pa., 12 miles from its home plant . . . . LIMA LOCOMOTIVE WORKS, INC., and the GENERAL MACHINERY CORP. of Hamilton, Ohio, recently merged to form the LIMA-HAMILTON CORP. and thus have increased plant space . . . . THE TIMKEN ROLLER BEARING Co. has purchased an 8-acre site and taken over all construction on the new $150,000 rock bit plant at Colorado Springs, Colo. The plant was originally to be built by the Colorado Springs Chamber of Commerce and leased to the company . . . . Plans are under way for construction at Anderson, Calif., of the largest ponderosa and sugar pine plywood plant in the country, according to the UNITED STATES PLYWOOD CORP. . . . ECONOMY PUMPS, INC., of Hamilton, Ohio, recently acquired a $705,000 wartime addition to its plant, built by the Defense Plant Corporation. . . . Construction has started on an oxygen filling station and acetylene producing plant at Creve Coeur, a suburb of Peoria, Ill., for the LINDE AIR PRODUCTS Co.

Home Office Changes—Anthony J. Zino, Jr. has been appointed assistant sales manager of the Industrial sales division of the SWAN-FINCH OIL CORP. New York City. . . . Arthur Nikand has been appointed factory manager of the Portland, Ore., plant for the HYSTER Co. . . . THE LEHIGH PORTLAND CEMENT Co. has elected C. Glenn Browning as vice-president and general sales manager. . . . W. E. Madden is now sales and division manager of the conveyor division of the GEORGE HAISS MANUFACTURING Co. of New York City. . . .

(*Continued from page* 176)

A FEW OF THE MANY WAYS APAC SHEATHING CAN HELP YOU

- **Exterior siding**
- **Interior sheathing**
- **Office paneling**
- **Partitions**
- **Linings for elevator casings**
- **Shower stalls**

Nature made Asbestos...
Keasbey & Mattison has made it serve mankind since 1873.

K&M best in asbestos ®

The owners of this water cooling tower formerly believed raw redwood was the only material able to withstand the moisture conditions. Apac has proved superior both in efficiency and appearance.

K&M "Century" APAC

ASBESTOS-CEMENT SHEETS

You've known for years that asbestos-cement is a highly fire-resistant combination. But here's a case where asbestos-cement sheets were used to combat an enemy of exactly the opposite type—the corrosive effects of moisture.

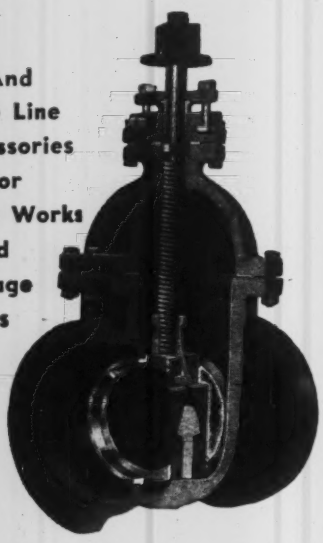
The paneling on this water cooling tower is K&M "Century" Apac—a flat asbestos-cement building sheet that has as many uses as a building has surfaces. Apac won't rot, won't rust, and actually grows tougher with age. It never needs protective painting or other upkeep.

Apac is furnished in thicknesses of 3/16", 1/4" and 3/8". Standard sheet is 4' x 8'. And it's easy to cut—just score and snap off. Nails or screws hold it firmly in place. These advantages, plus surprisingly low cost, make "Century" Apac an unusually economical material. Write us for full details about K&M "Century" Apac—we'll attend to your inquiry promptly.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

HYDRANTS & VALVES

And Pipe Line Accessories for Water Works and Sewage Works



VALVES: A.W.W.A. type, iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals. Dry top revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

M & H PRODUCTS INCLUDE

FIRE HYDRANTS
GATE VALVES
TAPPING VALVES
WALL CASTINGS
SPECIAL CASTINGS
TAPPING SLEEVES
CHECK VALVES
FLOOR STANDS
EXTENSION STEMS
CUTTING-IN TEES
SHEAR GATES
MUD VALVES
VALVE BOXES
FLAP VALVES
SLUDGE SHOES
FLANGE AND FLARE FITTINGS
FLANGED FITTINGS
B & S FITTINGS

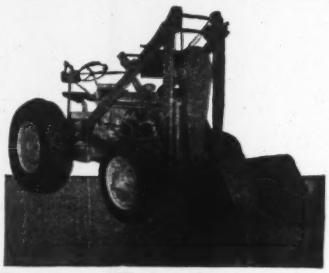
Write for Catalog No. 34

M & H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

Charles D'W. Gibson and John A. Hill, vice-presidents of the AIR REDUCTION CO., INC., have been elected directors of the company. . . . THE PITTSBURGH PLATE GLASS CO. has appointed Thomas G. Wright as assistant to the general superintendent of the firm's factories. . . . FAWICK AIRFLEX CO., INC. has appointed Richard Scott Huxtable as executive vice-president and general manager. . . . THE AMERICAN COACH & BODY CO. of Cleveland, Ohio, has appointed Leonard A. Stewart as chief engineer. . . . Philip G. Deuchler has been appointed to the new position of production manager of the roofing division of the CELOTEX CORP. . . . Lee S. COULTER is now manager of the industrial sales division of AMERICAN HOIST & DERRICK CO. . . . Admiral W. A. Fitch, USN, retired, has become vice-president of the GENERAL TIRE & RUBBER EXPORT CO. . . . K. A. Helmly has been promoted to manager of operations for the SOUTHERN STATES IRON ROOFING CO. . . . T. G. Gill has joined the laboratory staff of the TIMBER ENGINEERING CO. . . . Larry M. Baker is now manager of interplant technical service for the GENERAL TIRE & RUBBER CO. . . . THE TIMKEN ROLLER BEARING CO. has announced the transfer of William E. Bryden, sales engineer, to its Cincinnati, Ohio, office. . . . Jack H. Gill has been appointed engine sales consultant for the CATERPILLAR TRACTOR CO. . . . The Plaskin Division of LIBBEY-OWENS-FORD GLASS CO. has named Carleton Ellis, Jr., director of purchases. . . . WAGNER ELECTRIC CORP. announces the appointment of M. E. Comstock as manager of its electrical division branch office in Boston, Mass. . . . Weston G. Frome, general manager of the ATLAS POWDER CO.'s explosives department, was elected a vice-president of the company recently . . . . B. J. C. van der Hoeven is now assistant general manager of the chemical division of KOPPERS CO., INC. . . . R. B. Moir is now assistant vice-president in charge of engineering product development for the Industrial Gear Division of FOTE BROS. GEAR AND MACHINE CORP.

Miscellany—Diesel Crawler tractors and bulldozers; wheel tractors and other diesel and gasoline driven equipment are now on display at the INTERNATIONAL HARVESTER'S "100 Years in Chicago" exhibition near Soldier Field. . . . The Joseph A. Holmes medal of honor was awarded recently to A. J. R. Curtis, safety director of the PORTLAND CEMENT ASSOCIATION. . . . Maurice Maskrey is now president of the CLAY SEWER PIPE ASSOCIATION, with headquarters at Columbus, Ohio. . . . THE MAPLE FLOORING MANUFACTURERS ASSOCIATION, celebrated its 50th anniversary this year. . . .



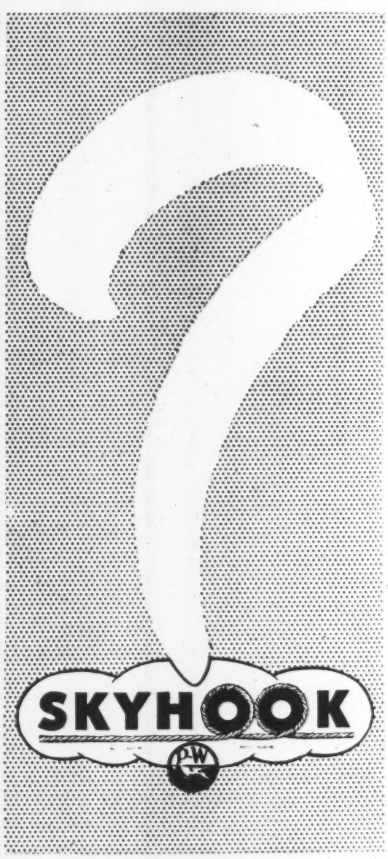
FRONT END LOADERS

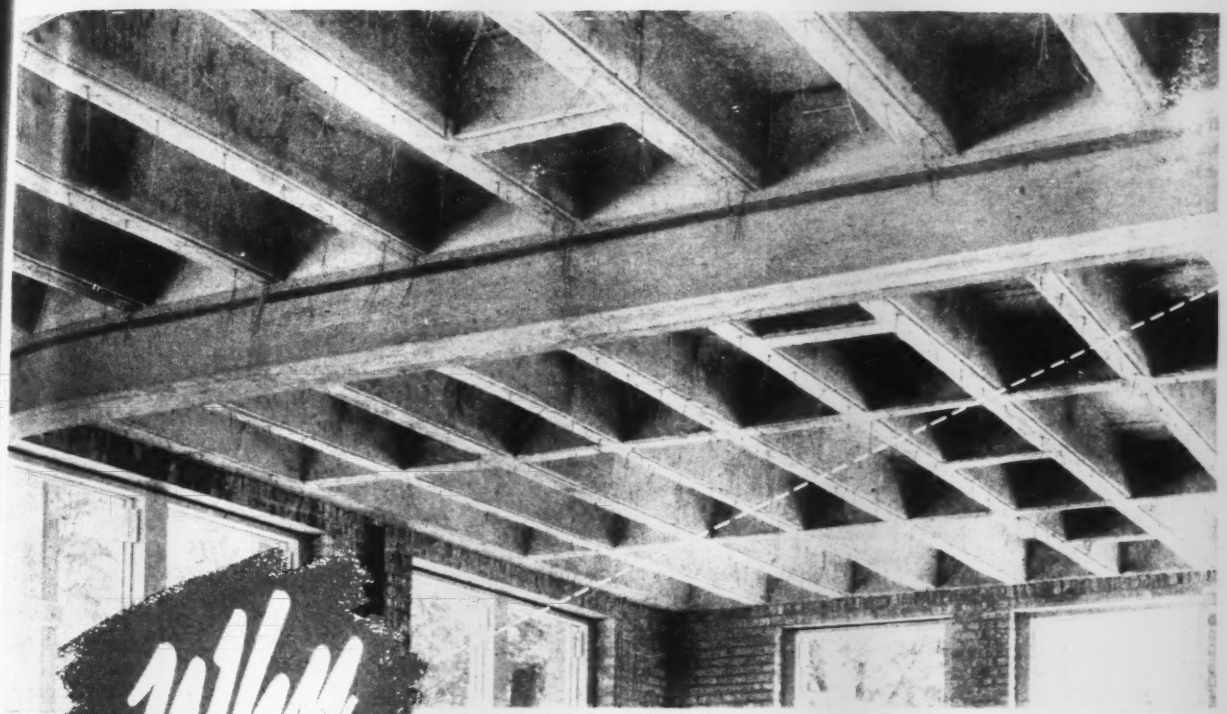
For Industrial Tractors
Extension Booms— 8' Lift
½ and ⅝ cu. yd. Capacity

Other Products
CONCRETE VIBRATORS
Gasoline Engine and Electric Motor Driven Model
HEATING KETTLES
for Asphalt and Tar
AGGREGATE DRYERS
for Stone and Sand
ASPHALT PLANTS
Portable—Stationary

Write for Circular

White Mfg. Co.
ELKHART INDIANA





Why Concrete Joist Construction?

Because Today's Costs are NOT Out of Line . . .

Because, strength and durability considered, concrete joist construction is the most economical way to build . . .

In these days of high costs, economy in building is important, provided strength and durability are not sacrificed. Here is where concrete joist construction comes in—since it provides rigid, strong, sound-proof buildings which are fire resistive, yet construction cost is lower. That is because the amount of concrete and, consequently, the dead load, are kept to a minimum for any span or live load. The concrete joist and monolithic top slab are formed with cores of removable Meyer steelforms, supported on skeleton centering. Once the concrete has set, the forms are removed and re-used from floor to floor and from job to job. Therefore, a nominal rental charge can be made for each use. Construction is speeded up.

WHY SPECIFY CECO?

Ceco originated the removable steelform method of concrete joist construction. The company is first in the field—actually providing more services than all competitors combined. So, when concrete joist construction fits your need, call on Ceco, the leader over all. Thirty-five years of experience in the field, on the job, have given Ceco a sure grasp of all concrete joist construction problems. This fund of knowledge is yours to command, in 23 strategically located offices from coast to coast.

CECO STEEL PRODUCTS CORPORATION

General Offices: 5701 W. 26th St., Chicago 50, Illinois

Offices, warehouses and fabricating plants in principal cities

Other Ceco Products Include—Reinforcing Steel, Welded Wire Fabric, Steel Joists and Roof Deck, Metal Windows and Doors, Metal Frame Screens, Aluminum Storm Windows, Metal Lath and Accessories

CECO STEEL

In construction products **CECO ENGINEERING** *makes the big difference*

WANT MORE EFFECTIVE HEAT?

GET IT THIS WINTER WITH HERMAN NELSON PORTABLE HEATERS

Speed up work by:

SPACE HEATING of temporary buildings," storage sheds, repair shops, buildings under construction.

PREHEATING engines and all kinds of mechanical equipment.

SPOT HEATING of materials, workmen, machinery, storage tanks, tools.

THAWING frozen areas and machinery, wheels, gears, transmissions, caterpillars, etc.

DRYING and curing of materials, plaster, paint, mortar, concrete, etc.

VENTILATING and heating of manholes, tunnels, box cars, ship holds, confined areas of all kinds.

It's not the heat *in* a fuel that counts—it's the ***effective*** heat you can get ***out*** of it. With Herman Nelson Portable Heaters you get quick, clean, safe heat — where you want it — when you want it — without waste. No smoke . . . no soot . . . no open flame! You'll step up production, lengthen the working season, avoid costly delays—when Herman Nelson Portable Heaters are on the job to ***protect men, machinery and materials*** against cold. No bigger than a kitchen stove, this unit provides enough heat for three ordinary 5-room houses!

Write for Interesting, Free Booklet on "Cost Control"

★ **ENOUGH HEAT FOR THREE ORDINARY FIVE-ROOM HOUSES**

★ **NO BIGGER THAN A KITCHEN STOVE**

★ **NO SMOKE—NO SOOT — NO OPEN FLAME**

THE HERMAN NELSON CORPORATION MOLINE ILLINOIS

SINCE 1906 MANUFACTURERS OF QUALITY HEATING AND VENTILATING PRODUCTS

MacArthur

37 YEARS INSTALLING PILES OF EVERY TYPE

CAST-IN-PLACE CONCRETE COMPOSITE

STEEL SECTIONAL PIPE TIMBER

SOIL AND ROCK BORINGS

MacARTHUR CONCRETE PILE CORPORATION

18 EAST 48th STREET. NEW YORK 17, N. Y.

BOSTON • CINCINNATI • NEW ORLEANS

Engineering School News

Victor A. Hyde, senior planning technician of the Alabama State Planning Board, has been appointed to the staff of the University of Illinois as assistant professor of community planning and will engage primarily in field work throughout Illinois, extending the services of the University of Illinois bureau of community planning. Mr. Hyde is a graduate of Ohio State University and got his master's degree from the University of Tennessee. He has taught at the latter institution and has served with the project planning division of the Tennessee Valley Authority and with the Alabama State Planning Board.

The recent first Virginia highway conference at the Virginia Military Institute, Lexington, attracted about 600 state, city and county officials, and representatives of national road-building and highway organizations. It is said that it may be the precursor of an annual Old Dominion Road School.

Howard L. Furr has returned to the civil engineering faculty at Texas A. & M. College after an absence to serve in the armed forces and with the Southern Railway in Cincinnati, Ohio. He is a graduate of Mississippi State College.

The Newark, N. J., College of Engineering has awarded construction contracts for its $500,000 laboratory addition.

A complete listing of commercial and university testing and research laboratories throughout the country, together with indications of the type of commodities tested, has been compiled by the National Bureau of Standards. This pamphlet is now available from the Government Printing Office as NBS Miscellaneous Publication M187 entitled "Directory of Commercial and College Laboratories."

Elmer C. Osgood and Karl N. Hendrickson have joined the staff of the civil engineering department of the University of Massachusetts as assistant professors. Mr. Osgood had several years of structural engineering experience with the public works department of the Department of the Navy. Mr. Hendrickson was a lieutenant commander in the Navy and headed the C.E.C. Midshipman School at Camp Endicott, R. I.

FINISHING A SLOPE . . . without leaving tire marks

BUILDING A ROAD . . . moving a tremendous windrow.

MIXING BLACKTOP . . . all wheels miss the windrow.

RIDING A LONG SLOPE . . . All-Wheel Steer holds both ends steady.

CLEANING A WET DITCH . . . keeping rear truck on road.

"99-H"

Built to Outperform

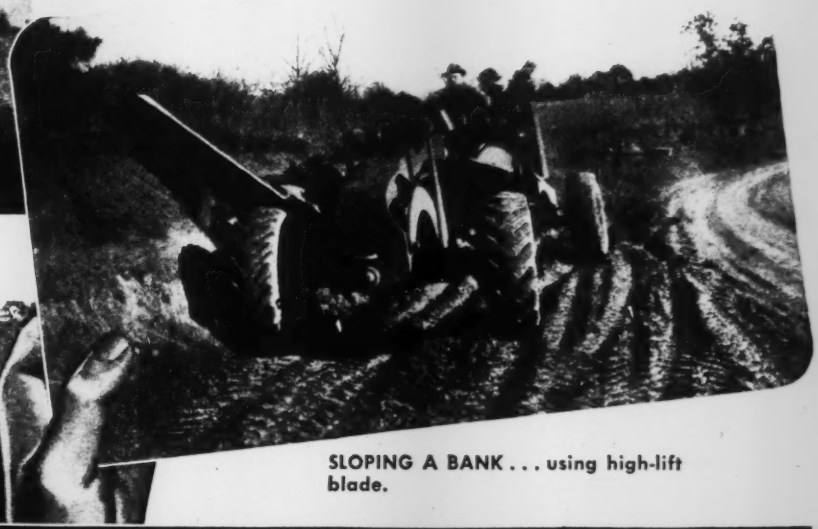
No Motor Grader without All-Wheel Drive and All-Wheel Steer can hope to equal the all-around operating efficiency of the Austin-Western "99-H" Power Grader, with its High-Lift Blade, Extreme Blade Reach and Completely Reversible Blade.

On the "99-H" there are no idling front wheels—no dead front end to consume power and decrease operating efficiency. The entire weight of the machine is on the driving wheels—front and rear—contributing 100% to traction, and getting the most out of the 13-foot blade.

All-Wheel Steer provides unequalled maneuverability; saves time on every job; makes it possible to work in places where ordinary motor graders cannot go—do things they cannot do.

AUSTIN-WESTERN COMPANY • AURORA, ILLINOIS

Yes - it's the Power Grader that has Everything



SLOPING A BANK . . . using high-lift blade.

BUILDERS OF ROAD MACHINERY

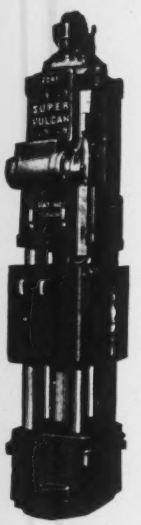
Austin Western

SINCE 1859

FOR PENETRATION

SUPER-VULCAN OPEN TYPE DIFFERENTIAL-ACTING PILE HAMMERS 18C, 30C, 50C and 80C

• In Super-Vulcan this symbol of power becomes an active, smashing force that sinks any kind of pile quickly and economically on the toughest job. That's where claims give way to facts, and that's where Super-Vulcan has proved and continues to prove its exceptional value through dependable performance that produces positive penetration.



Sizes 18C—30C—50C—80C meet all needs

For on the job Super-Vulcan delivers twice the usual number of powerful blows per minute on 25 to 35 per cent less steam per blow. And its rugged strength, long-time durability, simple design and ease of operation produce pile driving efficiency that means more piles down per dollar.

Find out about Super-Vulcan, the pile hammer that gets you greater penetration per blow. Write for full details.

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(*Continued from page* 128)

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Reports and Pamphlets

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PUBLIC WATER SUPPLIES OF ARKANSAS—Research Series No. 11. University of Arkansas Bulletin, Fayetteville, Arkansas.

MOISTURE AND TEMPERATURE CONTROL IN BUILDINGS UTILIZING STRUCTURAL INSULATING BOARD—Bulletin No. 26—By F. B. Rowley, M. H. LaJoy and E. T. Erickson. University of Minnesota, Engineering Experiment Station, Minneapolis, Minn.

OHIO HIGHWAY ENGINEERING CONFERENCE—Bulletin No. 129. Engineering Experiment Station, Ohio State University, Columbus 10, Ohio. $1.

TOLL BRIDGE INFLUENCE ON HIGHWAY TRAFFIC OPERATION—Technical Report No. 2—By M. Earl Campbell. Bureau of Highway Traffic, Yale University, New Haven, Conn.

SEPTIC TANKS FOR RURAL AND SUBURBAN AREAS—M.D.H. Engineering Bulletin 2—Michigan State College, East Lansing, Mich.

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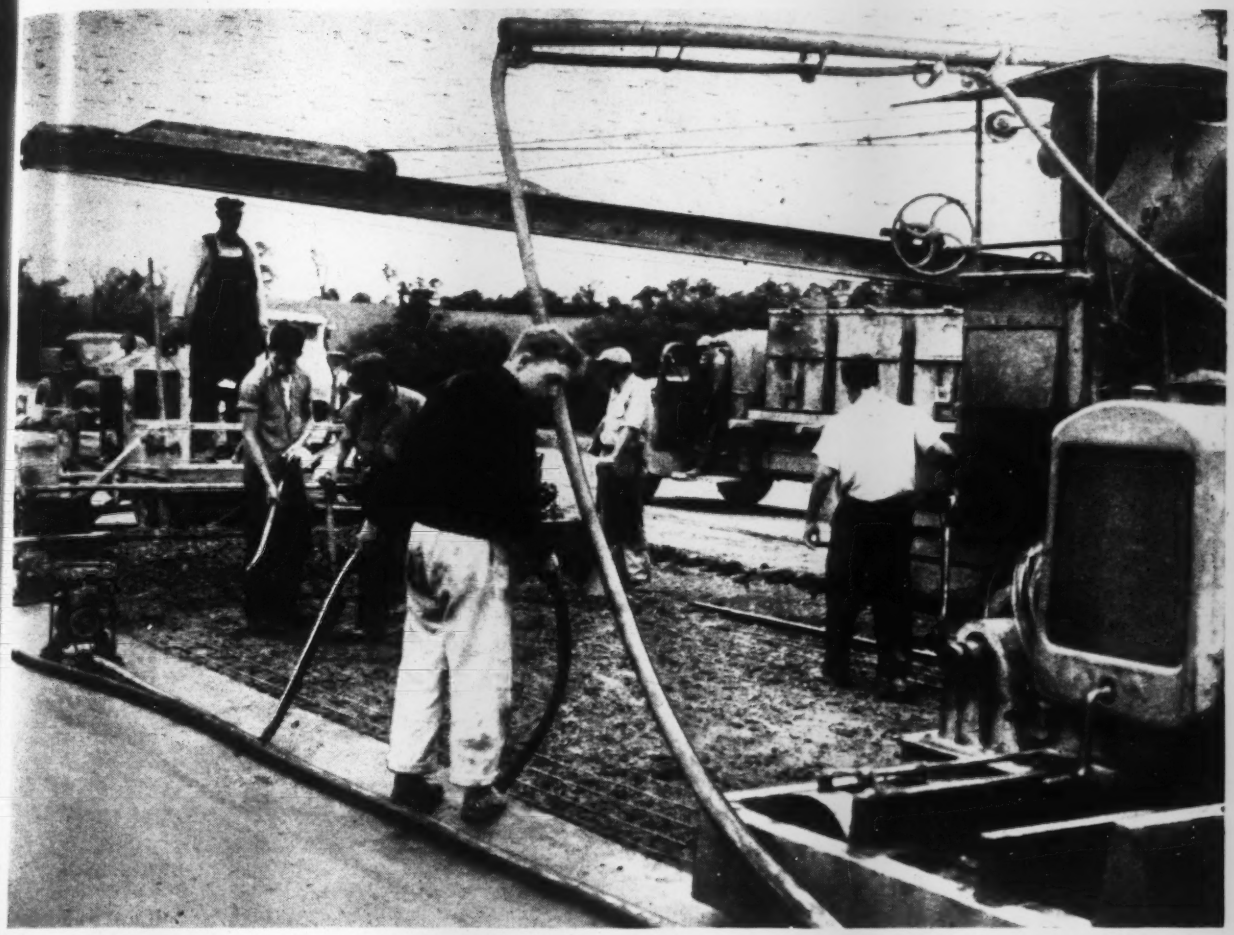

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BIBLIOGRAPHY AND INDEX OF PUBLICATIONS RELATING TO GROUND WATER (Paper 99)—U. S. Geological Survey. For sale by Superintendent of Documents, Washington 25, D. C. $1.

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